WORLD TRADE CENTER
TOWERS 1 & 2
STRUCTURAL INTEGRITY INSPECTION
ACCESSIBLE COLUMNS
14 APRIL 1995

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14 April 1995
File: P1113903

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Executive Summary

Leslie E. Robertson, R.L.L.P., (LERA) carried out a survey of the accessible columns in the elevator shafts of One and Two World Trade Center as part of the ongoing structural integrity inspections. This survey was undertaken for the purpose of ascertaining the condition of the accessible columns in the elevator shafts in terms of the overall structural integrity of the accessible columns, for signs of rust or cracking, bowing, or deviation from plump, to identify specific locations of structural distress or damage, to identify locations of damage to the fireproofing envelopes, for lateral displacement or rotation of the column about a vertical axis where the column is braced directly on only one axis by connecting beams or abutting concrete slabs due to large beam offset dimensions, for signs of rust, or deformation of the slabs on ground surrounding each column at sub-level, and to provide recommendations for remedial work for both structural and fireproofing damage.

Most of the information presented in this report originates from on-site observations of selected columns within elevator shafts made by LERA during March 1995. The visual assessment of the accessible columns in the elevator shaft was carried out from the top of the elevator cars, by a field inspector. A total of 24(Twenty-four) elevator shafts and 56(Fifty-six) elevator pits were selected, this selection included 10 local elevators and 14 express elevators.

The accessible columns in the selected elevator shafts of One and Two World Trade Center are generally in good condition, no structural deficiencies such as cracking or bowing were found, the most common irregularities observed were missing fireproofing and light surface rusting of the exposed steel.

Based on our observation and our evaluations of the inspection, we believe that the structural integrity of the accessible columns within the selected elevator shafts are satisfactory. Areas of concern, in terms of remedial work to be taken, are the fireproofing envelopes and the corrosion of the exposed steel. We recommend that the fireproofing be repaired on all columns within the selected elevator shafts. We also recommend that the exposed areas of steel be cleaned prior to re-fireproofing.

Introduction

As part of the PANYNJ structural inspection program, LERA has carried out a survey of the accessible columns in the elevator shafts of One and Two World Trade Center. The inspection was performed during March 1995 by Mr. Khalid Eid of LERA. Access to the selected elevator shafts was provided by Mr. Thomas C. Terminelle and Mr. Frank J. Dellolio of A.C.E. Elevators Co.

This report is the second in a continuing program which will appraise the condition of accessible columns in the World Trade Center Complex. Refer to World Trade Center Structural Integrity Inspection Report No. 1 of Accessible Columns at 1 ,2 4, and 5 WTC, dated 29 January 1993.

Accessible columns are those columns which are not enclosed by an architectural finish and can be visually inspected. The original architectural drawings were researched and accessible columns situated within elevator shafts were selected for this inspection. Selected shafts were chosen on the basis of the quantity and types of inspectable columns within the shaft and convenience to the PANYNJ.

The purpose of this inspection is to assess the overall structural integrity of the accessible columns. The columns were visually inspected for signs of rust or cracking, bowing, or deviation from plumb and loss or fireproofing. At columns in elevator shafts, where the column is braced directly on only one axis by connecting beams or abutting concrete slabs due to large beam offset dimensions, the columns were visually inspected for lateral displacement or rotation of the column about a vertical axis. At sub-level, the slabs on ground surrounding each column were visually inspected for signs of rust or deformation. Recommendations for remedial work are provided for both structural and fireproofing damage.

The following report of our inspection includes:

- A description of the structure, which describe the components of the accessible columns.
- The inspection methodology, which describe the accomplishment of the inspection.
- The detailed inspection findings, which describe our inspection findings and our opinions concerning the findings and our recommendations for remedial action.
- The conclusions and recommendations, which based on our detailed inspection findings and our evaluations.

- The Limitation of Report, which represent our professional view in this report.
- Appendix A - Lists the numbers of the architectural plans of the inspected columns within the selected shafts.
- Appendix B - Includes the listing of the photographs taken to clarify the location and condition of defective parts and our suggested remedial action.
- Appendix C - Includes the Listing of Inspected Columns.
- Appendix D - Includes the Inspector's notes.
- Appendix E & F - Includes; figures, elevations, photographs of each tower.
- Appendix G - Includes; Typical Structural details and fireproofing system details.
- Appendix H - Includes general notes and specifications for spray-on fireproofing, appended for reference purposes only.

DESCRIPTION OF STRUCTURES

Accessible columns are those columns which are not enclosed in an architectural finish. Accessible columns are located in a rectangular core (The elevator area). The core supports much of the gravity loading. Above the 7th floor the core does not share in resisting lateral forces to any significant extent. The core columns in the upper stories are rolled wide-flange shapes; as column loads accumulate in the lower floors the rolled shapes are replaced by built-up box sections (see Appendix G, for typical column details). The floor framing within the core consists of rolled steel beams supporting formed concrete slabs or slabs on steel deck. Below the 7th floor the core is x-braced to carry lateral loads down to the plaza level and below.

INSPECTION METHODOLOGY

Since the concurrent visual inspection of all the accessible columns or even a major portion of them is not a practical goal, a statistical approach is followed. This approach involves the sampling of those components and systems which are more important to structural integrity, and at locations with a relatively higher potential for occurrence of defects or problems. A visual inspection of the accessible columns located in the rectangular core (the elevator area) was made from the top of the elevator cars and from a walk-through of the elevator pits. The elevator car was operated by a field inspector from A.C.E. Elevator Co. The operator ran the elevator car at a very slow speed from the top of the car. Within the bounds of the suggested sampling procedure, the inspection frequency and the building layout, it was anticipated that the inspection work could be organized to proceed in a more or less linear sequence to minimize both wasted motion and duplication of effort, and to help assure that no important item was missed. The inspection team carried a set of reduced drawings, individual field notebook, a camera and a flashlight, methods and procedures were conformed strictly to the Port Authority safety regulations.

Visual inspection was supplemented by the use of simple hand tool such as a screw driver as needed. Where structural steel columns or the connecting beams were covered by spray-on fireproofing, removal of loose, cracked or rust-stained cover material was provided to examine the steel. A number of on-site visits were made to obtain the current condition of the accessible columns. No lifts were used for the inspection. The inspection findings were recorded on copies of architectural drawings. The accessible columns were not directly visible due to their fireproofing; therefore, the focus of the visual observations depended largely on the condition of the fireproofing. However, in several instances, the structural columns and the connecting beams were visible for inspection purposes or due to spalling of fireproofing.

INSPECTION METHODOLOGY (continued)

The inspected columns within the elevator shaft were identified as to general location (building number, floor or floors), description label (column number, elevator number) and the type and location of the affected part. Further, photographs were taken to clarify the location and condition of the defective parts. If defects were encountered, their location was noted and the defects was photographed. Under some circumstances where defects had similar characteristics, only one photograph was taken. If defects were not encountered, inspection notes and photographs were not taken. Each accessible column within the elevator shaft was inspected for signs of rust or cracking, bowing, or deviation from plump, to identify specific locations of structural distress or damage, to identify locations of damage to the fireproofing envelopes, for lateral displacement or rotation of the column about a vertical axis where the column is braced directly on only one axis by connecting beams or abutting concrete slabs due to large beam offset dimensions, for signs of rust, or deformation of the slabs on ground surrounding each column at sub-level.

DETAILED INSPECTION FINDINGS

This report details the findings of the inspection of the selected accessible columns within elevator shafts. Our inspection findings and our opinions concerning the findings and our recommendations for remedial action are summarized below. Detailed inspection findings can be found in Appendix E and F.

The inspection was undertaken to ascertain the condition of the columns in the elevator shafts in terms of the overall structural integrity. Columns were observed for signs of rust or cracking, bowing, or deviation from plump, to identify specific locations of structural distress or damage, to identify locations of damage to the fireproofing envelopes, for lateral displacement or rotation of the column about a vertical axis where the column is braced directly on only one axis by connecting beams or abutting concrete slabs due to large beam offset dimensions, for signs of rust, or deformation of the slab on ground surrounding each column at sub-level, and to provide recommendations for remedial work for both structural and fireproofing damage.

Most of the information originated from on-site observations of selected columns within elevator shafts made by LERA during March 1995. The visual assessment of the accessible columns in the elevator shafts was carried out from the top of the elevators cars, by a field inspector. A total of 24(Twenty-four) elevator shafts and 56(Fifty-six) elevator pits were selected, this selection included 10(Ten) local elevators and 14(Fourteen) express elevators.

The accessible columns in the selected elevator shafts of One and Two World Trade Center are generally in good condition, no structural deficiencies such as cracking or bowing were found, the most common irregularity in both the express and the local elevator shaft were spalling & missing of fireproofing, the probable cause of this spalling may be attribute to rubbing of the hoist cables against the face of column, or air pressure induced due to high speed of the elevator cars moving up and down the shaft, or due to testing purposes. The exposed steel revealed only light to moderate surface rust.

DETAILED INSPECTION FINDINGS (continued)

Spray fireproofing is applied to the accessible columns within the elevator shafts and is also applied to connecting beams. There were two types of fireproofing system protect the accessible columns in the elevator shafts; spray-on or asbestos spray fireproofing and spray-on coated with cementitious fireproofing. Three major types of defects associated with the spray fireproofing were observed during our inspection. These are presented in descending order of occurrence, as follows:

- spray fireproofing damage or spalling; at support brackets for conduits and elevator hardware, it appears that the fireproofing was removed or damaged when these brackets were installed. Several areas were found to have fireproofing that was purposely removed for inspection purposes. The majority of the fireproofing removal occurred in column splice regions, this condition allowed for excellent visibility of the structural steel columns. It was noticed that typical patches of spalling fireproofing caused probably by rubbing of hoist cables against the connecting beams and column faces and by the air pressures induced due to the high speed of the elevators moving up and down the shafts.

- deterioration of spray fireproofing; large areas of fireproofing were missing from the face of column at service elevators (elevator shaft 50A, 49A and 50B, 49B). The probable cause of this deterioration is rubbing of the hoist cables against the face of the column, or air pressure induced due to high speed of the elevator car moving up and down the shaft.

- accumulation of debris in elevator pits; it was observed that in several elevator pits, the corner region near the accessible column has been used as a receptacle for the accumulation of debris.

- water leaks and corrosion; it was observed that in almost all of the inspected elevator pits, the column surface within 3 foot above the pit has been corroded. The corrosion was classified as light to moderate.

CONCLUSIONS AND RECOMMENDATIONS

Our opinions concerning the findings and our recommendations for remedial action are summarized below. Detailed suggested remedial action can be found in Appendix B, E and F.

Based on the survey data we collected and our evaluations of this data, we believe that the structural integrity of the accessible column in the selected elevator shafts is satisfactory. We recommend that remedial action to be taken where spray fireproofing is damaged, deteriorated or missing and where there is corrosion of the column base due to water leaks in the elevator pits.

The following are our specific recommendations for the structural and fireproofing damage we observed.

Spalling, Missing and Damaged Fireproofing

We recommend that the exposed areas of steel be properly cleaned and then protected with fireproofing. The existing spray fireproofing may contain asbestos, therefore, adequate measures need be undertaken to ascertain the presence of asbestos and to ensure both the protection of personnel and the proper handling of the material.

Water Leaks, Corrosion and Accumulation of Debris in Elevator Pits

At express and local elevator pits of both 1 WTC and 2 WTC, where evidence of past or present water leaks has occurred, we recommend that the following action be taken:

- areas of current water leaks be drained;
- where steel has been corroded, chip away the floor concrete surrounding corroded steel to a depth where corrosion no longer exists;
- clean and inspect all the steel, welds and bolts at these locations to determine the extent of corrosion;
- repair steel, welds and bolts as required; and
- prior to re-fireproofing steel, paint with a zinc-rich paint.

We also recommend that the accumulation of debris in elevator pits be removed and a maintenance program involving cleaning be provided.

Limitations of Report

The opinions expressed in this report represent our professional view, based on the information made available to us. In developing these opinions, we have exercised a degree of care and skill commensurate with that exercised by reputable structural engineers of this location. No other warranty, expressed or implied, is made as to the professional advice included in this report.

We appreciate this further opportunity to assist the Port Authority of New York and New Jersey.

Please call us for any questions you may have.

Sincerely,

Khalid M. Eid

KME/lc

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APPENDIX A

LIST OF ARCHITECTURAL PLANS

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14 April 1995
File: 1113903

ARCHITECTURAL PLANS

Drawing No.	Title
A•A•20	1ST FLOOR CORE PLAN (1 WTC)
A•A•73	44TH FLOOR CORE PLAN (1 WTC)
A•A•131	78TH FLOOR CORE PLAN (1 WTC)
A•B•21	1ST FLOOR CORE PLAN (2 WTC)
A•B•79	44TH FLOOR CORE PLAN (2 WTC)
A•B•137	78TH FLOOR CORE PLAN (2 WTC)

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APPENDIX B

PHOTOGRAPHS LISTING

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KEY

I FIREPROOFING TYPE

FP1 Spray-On or Asbestos Spray Fireproofing
FP2 Spray-On Coated with Cementitious Fireproofing

II SUGGESTED REMEDIAL ACTION TO BE TAKEN

1 No action required at this time.

2 Re-fireproof as per Appendix G at discretion of PANYNJ.

3 Patch Miscellaneous fireproofings as per Appendix G

4 Note existing condition and re-evaluate at next inspection.

5.
1. Remove the existing fireproofing, where steel has been corroded, chip away the concrete floor surrounding corroded steel to a depth where corrosion no longer exists
2. Clean and inspect all the steel and the connection at these locations to determine the extent of rust damage
3. Repair steel and connections as required
4. Prior to re-fireproofing steel, paint with a Zinc-Rich Paint

6 Repair loose materials at support bracket.

7. Repair stiffner plate at connecting beam to column as required.

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PHOTOGRAPH LISTING OF 1 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
1	1WTC - COL. #908 ELEV. SHAFT #1A FLOOR 31 LOOKING UP TYPICAL 2ND-44TH	• DETERIORATION OF S.F.P. AT CONNECTING BEAMS • STEEL EXPOSED AT THE BOTTOM FLANGE OF CONNECTING BEAMS • STEEL EXPOSED AT THE EAST FACE OF COLUMN AT CONNECTING BEAMS	FP1	3
2	1WTC - COL. #908 ELEV. SHAFT #1A BTWN. 27TH-29TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2
3	1WTC - COL. #908 ELEV. PIT # 1A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
4	1WTC - COL. #907 ELEV. SHAFT #2A 9TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2,3
5	1WTC - COL. #907 ELEV. SHAFT #2A BTWN 30-31ST FL. SIMILAR CONDITION AT 34TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2
6	1WTC - COL. #907 ELEV. SHAFT #2A 36TH, 37TH & 38TH FLOOR	• NO FIREPROOFING PRESENT AT CONNECTING BEAMS • LIGHT SURFACE RUST	FP1	2
7	1WTC - COL. #907 ELEV. SHAFT #3A 34TH FLOOR SIMILAR CONDITION AT 9TH & 28TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2
8	1WTC - COL. #907 ELEV. SHAFT #3A 29TH FLOOR	• MODERATE SURFACE RUST AT CONNECTION TO COLUMN • DETERIORATION OF S.F.P. • ONE BOLT WAS MISSING	FP1	3
9	1WTC - COL. #907 ELEV. SHAFT #3A BTWN 16TH-20TH FLOOR	• LARGE AREA OF SPALLING FIREPROOFING • DETERIORATION OF S.F.P. AT CONNECTING BEAMS	FP1	2
10	1WTC - COL. #907 ELEV. PIT #3A LEVEL B2	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2

PHOTOGRAPH LISTING OF 1 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
11	1WTC - COL. #906 ELEV. PIT #4A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP2	5
12	1WTC - COL. #903 ELEV. SHAFT #8A 38TH & 39TH FLOOR SIMILAR CONDITION AT 33RD, 34TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2,3
13	1WTC - COL. #903 ELEV. SHAFT #8A 31ST FLOOR	• NO FIREPROOFING PRESENT AT CONNECTING BEAMS • LIGHT SURFACE RUST	FP1	2
14	1WTC - COL. 902 ELEV. SHAFT #9A 39TH & 41ST FLOOR SIMILAR CONDITION AT 43RD FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2
15	1WTC - COL. #902 ELEV. PIT #9A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
16	1WTC -COL. #601 ELEV. SHAFT #12A 70TH FLOOR TYPICAL AT ALL ELEVATOR SHAFTS	• STEEL EXPOSED AT SUPPORT BRACKET FOR HOIST CABLE	FP1	3
17	1WTC - COL. #601 ELEV. SHAFT & 12A 55TH FLOOR TYPICAL 2ND-78TH FLOOR	• STEEL PIECE WAS LOOSE AT SUPPORT BRACKET	FP1	6,4
18	1WTC - COL. #605 ELEV. SHAFT #18A 3RD-5TH FLOOR	• WATER LEAKS TO FIREPROOFING ENVELOP AND CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS WITHIN 5 FOOT FROM COLUMN • MODERATE SURFACE RUST	FP2	3,4

PHOTOGRAPH LISTING OF 1 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
19	1WTC - COL. #605 ELEV. SHAFT #18A 3RD-5TH FLOOR	• WATER LEAKS TO FIREPROOFING ENVELOP AND CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS WITHIN 5 FOOT FROM COLUMN • MODERATE SURFACE RUST	FP2	5
20	1WTC - COL. #606 ELEV. SHAFT #19A 35TH - 39TH FLOOR SIMILAR CONDITION AT 8TH, 11TH, 19TH & 25TH-30TH FLOOR, 43RD-45TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
21	1WTC - COL. #607 ELEV. SHAFT #22A 28TH-30TH FLOOR TYPICAL 2ND-78TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2,3
22	1WTC - COL. #607 ELEV. PIT #22A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
23	1WTC - COL. #608 ELEV. SHAFT #23A 39TH FLOOR SIMILAR CONDITION AT 78TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • STEEL EXPOSED AT SUPPORT BRACKET FOR HOIST CABLE, TYPICAL CONDITION AT ALL FLOORS	FP1	2
24	1WTC - COL. #608 ELEV. SHAFT #23A FLOOR 12TH LOOKING UP TYPICAL 2ND-78TH FLOOR	• DETERIORATION OF S.F.P. ALONG THE LENGTH OF THE COLUMN AND ITS CONNECTING BEAMS • STEEL EXPOSED AT THE SUPPORT BRACKET FOR HOIST CABLE	FP1	3
25	1WTC - COL. #608 ELEV. SHAFT #23A 4TH FLOOR TYPICAL 2ND-78TH FLOOR	• DETERIORATION OF S.F.P. AT TOP FLANGE OF CONNECTING BEAMS • STEEL EXPOSED WITHIN 3 FOOT FROM COLUMN • MODERATE SURFACE RUST OBSERVED AT TOP FLANGE OF CONNECTING BEAM	FP1	3

PHOTOGRAPH LISTINGS OF 1 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
26	1WTC - COL. #608 ELEV. PIT #23A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	3
27	1WTC - COL. #704 ELEV. SHAFT #50A 45TH FLOOR TYPICAL B2-78TH FLOOR	• DETERIORATION OF S.F.P. ALONG THE LENGTH OF THE COLUMN • STEEL EXPOSED • LIGHT SURFACE RUST AT EDGE OF COLUMN	FP2	3
28	1WTC - COL. #704 ELEV. SHAFT #50A LEVEL B1	• EDGE OF COLUMN FLANGE EXPOSED • COLUMN SPLICE EXPOSED • LIGHT SURFACE RUST	FP2	2,3
29	1WTC - COL. #703 ELEV. SHAFT #50A 30TH FLOOR TYPICAL B1-78TH FLOOR	• DETERIORATION OF S.F.P. ALONG THE LENGTH OF THE COLUMN • STEEL EXPOSED ALONG THE EDGE OF THE COLUMN • LIGHT SURFACE RUST	FP1	2
30	1WTC - COL. #603 ELEV. PIT #15A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP2	5
31	1WTC - COL. #606 ELEV. PIT #21A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
32	1WTC - COL. #704 ELEV. PIT #49A LEVEL B3	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
33	1WTC - COL. #704 ELEV. PIT #49A LEVEL B3-B1	• DETERIORATION OF S.F.P. AT EDGE OF COLUMN • EDGE OF COLUMN EXPOSED • LIGHT SURFACE RUST	FP2	3
34	1WTC - COL. #802 ELEV. PIT #42A LEVEL B3	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
35	1WTC - COL. #905 ELEV. PIT #48A LEVEL B3	• DAMAGE TO FIREPROOFING ENVELOP AT BASE OF COLUMN • STEEL EXPOSED • LIGHT TO MODERATE SURFACE RUST	FP2	5

PHOTOGRAPH LISTING OF 2 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
36	2WTC - COL. #908 ELEV. SHAFT #1B 33-36TH FLOOR SIMILAR CONDITION AT 27-31ST FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
37	2WTC - COL. #907 ELEV. SHAFT #2B 21ST FLOOR - LOOKING UP	• TYPICAL CONDITION OF FIREPROOFING ENVELOPE	FP2	1
38	2WTC - COL. #902 ELEV. SHAFT #10B 34-36TH FLOOR SIMILAR CONDITION AT 7TH,20,22,25,39, & 40TH FLOOR	• LARGE AREA OF SPALLING FIREPROOFING • DETERIORATION OF S.F.P. AT CONNECTING BEAMS	FP1	2
39	2WTC - COL. #902 ELEV. SHAFT #10B 20TH FLOOR TYPICAL AT ALL FLOORS	• DETERIORATION OF S.F.P. ALONG EDGE OF COLUMN AND CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS	FP1	2,3
40	2WTC - COL. #902 ELEV. PIT #10B SIMILAR CONDITION AT ELEV. PIT #11B	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5
41	2WTC - COL. #901 ELEV. SHAFT #11B 31ST FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2,3
42	2WTC - COL. #901 ELEV. SHAFT #11B 15TH FLOOR TYPICAL CONDITION AT ALL FLOORS	• STEEL EXPOSED AT THE BOTTOM FLANGE OF CONNECTING BEAM • MODERATE SURFACE RUST	FP1	3
43	2WTC - COL. #601 ELEV. SHAFT #12B 35-37TH FLOOR SIMILAR CONDITION AT 25TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
44	2WTC - COL. #602 ELEV. SHAFT #13B 35-37TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
45	2WTC - COL. #602 ELEV. SHAFT #13B 12TH FLOOR SIMILAR CONDITON AT 7TH,10,14,27,48,63, 66 & 75TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	3

PHOTOGRAPH LISTING OF 2 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
46	2WTC - COL. #602 ELEV. SHAFT #14B 42ND FLOOR TYPICAL CONDITION	• STEEL EXPOSED AT ANTIWIND BRACKET GUIDE AT CORNER • LIGHT SURFACE RUST	FP2	3
47	2WTC - COL. #602 ELEV. SHAFT #14B 15TH FLOOR - LOOKING UP	• DETERIORATION OF S.F.P. AT CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS WITHIN 3 FOOT FROM COLUMN • LIGHT SURFACE RUST	FP2	3
48	2WTC - COL. #603 ELEV. SHAFT #15B 25TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
49	2WTC - COL. #603 ELEV. SHAFT #15B 3RD FLOOR - LOOKING UP	• WATER LEAKS TO FIREPROOFING ENVELOPE • DETERIORATION OF S.F.P.	FP2	3,4
50	2WTC - COL. #604 ELEV. PIT #17B	• DAMAGE TO FIREPROOFING ENVELOP AT BASE OF COLUMN • STEEL EXPOSED • LIGHT TO MODERATE SURFACE RUST	FP2	5
51	2WTC - COL. #605 ELEV. PIT #18B LEVEL B2 - LOOKING UP	• WATER LEAKS TO FIREPROOFING ENVELOPE • DETERIORATION OF S.F.P.	FP2	3,4
52	2WTC - COL. #606 ELEV. PIT #19B LEVEL B2 - LOOKING UP	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
53	2WTC - COL. #606 ELEV. PIT #20B LEVEL B2 - LOOKING UP	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP2	3
54	2WTC - COL. #607 ELEV. SHAFT #22B 29-30TH FLOOR SIMILAR CONDITION AT 47,57,59,64 & 74TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2
55	2WTC - COL. #608 ELEV. SHAFT #23B 70TH FLOOR TYPICAL CONDITION	• NO FIREPROOFING PRESENT AT THE NORTH FACE OF COLUMN AT CONNECTING BEAM	FP2	3

PHOTOGRAPH LISTING OF 2 WTC

PHOTO-GRAPH NO.	LOCATION	EXISTING CONDITIONS	FIREPROOFING TYPE	SUGGESTED REMEDIAL ACTION
56	2WTC - COL. #608 ELEV. SHAFT #23B 45TH FLOOR	• NO FIREPROOFING PRESENT AT THE NORTH FACE OF COLUMN WITHIN 6'-0" BELOW THE FLOOR LEVEL	FP2	2,3
57	2WTC - COL. #608 ELEV. SHAFT #23B 41ST FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING	FP2	2
58	2WTC - COL. #703 & 704 ELEV. SHAFT #50B 48TH FLOOR TYPICAL CONDITION	• DETERIORATION OF S.F.P. • STEEL EXPOSED AT CONNECTING BEAMS	FP1 FP2	2,3
59	2WTC - COL. #704 ELEV. SHAFT #50B 74TH FLOOR TYPICAL CONDITION	• DETERIORATION OF S.F.P. • STEEL EXPOSED AT CONNECTING BEAMS	FP1 FP2	2,3
60	2WTC - COL. #703 ELEV. SHAFT #50B 5TH FLOOR TYPICAL CONDITION	• DETERIORATION OF S.F.P. • STEEL EXPOSED	FP1	2,3
61	2WTC - COL. #703 ELEV. SHAFT #50B 17TH FLOOR	• THE STIFFNER PLATE AT CONNECTING BEAM TO COLUMN WAS TWISTED • STEEL EXPOSED	FP1	7
62	2WTC - COL. #704 ELEV. PIT #49B LEVEL B6	• COLUMN EXPOSED • LIGHT TO MODERATE SURFACE RUST OBSERVED • DEBRIS ACCUMMULATION	-	5
63	2WTC - COL. #703 ELEV. PIT #49B LEVEL B6	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	-	5
64	2WTC - COL. #903 ELEV. PIT #8B LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • LIGHT TO MODERATE SURFACE RUST OBSERVED	FP1	5
65	2WTC - COL. #903 ELEV. SHAFT #8B LEVEL B2, LOOKING UP	• DETERIORATION OF S.F.P.	FP1	3
66	2WTC - COL. #906 ELEV. SHAFT #5B	• DEBRIS ACCUMMILATION INSIDE THE ELEV. PIT	FP2	3
67	2WTC - COL. #803 ELEV. SHAFT #47B	• STEEL EXPOSED AT BASE OF COLUMN • LIGHT TO MODERATE SURFACE RUST OBSERVED	FP1	5

LERA

APPENDIX C

LISTING OF INSPECTED COLUMNS

LERA

LISTING OF INSPECTED COLUMNS AT 1 WTC

ELEVATOR SHAFT	COLUMN NUMBER	FLOORS INSPECTED	FACE OF COLUMN INSPECTED	LISTING OF PHOTOGRAPHS
1A	908	2-44 B2	WEST & SOUTH	1,2 3
2A	907	2-44 B2	EAST	4,5,6
3A	907	2-44 B2	WEST & SOUTH	7,8,9 10
4A	906	2-44 B2	EAST	- 11
8A	903	2-44 B2	WEST & SOUTH	12,13 -
9A	902	2-44 B2	EAST	14 15
12A	601	2-78 B2	EAST & NORTH	16,17 -
13A	602	2-78 B2	WEST & NORTH	- -
14A	602	B2	EAST	-
15A	603	B2	WEST & NORTH	30
18A	605	2-78 B2	EAST & NORTH	18,19 -
19A	606	2-78 B2	WEST	20 -
20A	606	B2	EAST & NORTH	31
21A	607	B2	WEST	-
22A	607	2-78 B2	EAST & NORTH	21 22

LISTING OF INSPECTED COLUMNS AT 1 WTC

ELEVATOR SHAFT	COLUMN NUMBER	FLOORS INSPECTED	FACE OF COLUMN INSPECTED	LISTING OF PHOTOGRAPHS
23A	608	2-78 B2	WEST & NORTH	23,24,25 26
24A	807	B3	WEST & NORTH	-
29A	806	B3	EAST & NORTH	-
30A	806	B3	WEST & NORTH	-
35A	805	B3	EAST & NORTH	-
36A	801	B3	EAST & NORTH	-
41A	802	B3	WEST & NORTH	-
42A	802	B3	EAST & NORTH	34
47A	803	B3	WEST & NORTH	-
48A	905	B3	EAST & SOUTH	35
49A	704	B3	NORTH	32,33
50A	704 703 803	2-108 2-78 2-108	WEST & SOUTH EAST EAST	27,28 29 -

LISTING OF INSPECTED COLUMNS AT 2 WTC

ELEVATOR SHAFT	COLUMN NUMBER	FLOORS INSPECTED	FACE OF COLUMN INSPECTED	LISTING OF PHOTOGRAPHS
1B	908	2-44 B2	EAST & SOUTH	36 -
2B	907	2-44 B2	NORTH	37 -
3B	907	B2	EAST & SOUTH	-
4B	906	B2	NORTH	-
5B	906	B2	EAST & SOUTH	66
6B	904	B2	EAST & SOUTH	-
7B	903	B2	NORTH	-
8B	903	B2	EAST & SOUTH	64,65
9B	902	B2	NORTH	-
10B	908	2-44 B2	EAST & SOUTH	38,39 40
11B	901	2-44 B2	EAST & NORTH	41,42 -
12B	601	2-44 B2	WEST & NORTH	43 -
13B	602	2-78 B2	WEST & SOUTH	44,45 -
14B	602	2-78 B2	NORTH	46,47
15B	603	2-78 B2	WEST & SOUTH	48,49 -
16B	603	B4	NORTH	-
17B	604	B4	WEST & SOUTH	50

LISTING OF INSPECTED COLUMNS AT 2 WTC

ELEVATOR SHAFT	COLUMN NUMBER	FLOORS INSPECTED	FACE OF COLUMN INSPECTED	LISTING OF PHOTOGRAPHS
18B	605	B2	WEST & NORTH	51
19B	606	B2	SOUTH	52
20B	606	B2	WEST & NORTH	53
21B	607	B2	SOUTH	-
22B	607	2-78 B2	WEST & NORTH	54 -
23B	608	2-78 B2	WEST & SOUTH	55,56,57
36B	801	B3	WEST & NORTH	-
41B	802	B3	WEST & SOUTH	-
42B	802	B3	WEST & NORTH	-
47B	803	B3	WEST & SOUTH	67
49B	704	B6	WEST & SOUTH	62,63
50B	704 703 803	2-108 2-78 2-108	EAST & SOUTH NORTH NORTH	58,59 60,61 -

LERA

APPENDIX D

INSPECTOR'S NOTES

LERA

Inspector's Notes

This report is the second in a continuing program of 10(Ten) reports of cycle progress 2/10 which will appraise the condition of all the accessible columns in the World Trade Center Complex.

No structural deficiencies such as cracking or bowing were found in any of the columns inspected.

The most common irregularities observed were missing fireproofing and light to moderate surface rusting of the exposed steel.

Refer to Appendix E & F, which includes;

- plot plan shuttle and freight elevators.
- 1st floor, 44th floor and 78th floor core plans.
- schematic section at shuttle and freight elevators of both towers.

Refer to Appendix G, which includes; Typical Structural details and Fireproofing System details.

Refer to Appendix H, which includes General Notes and Specifications for spray-on fireproofing, appended for reference purposes only.

APPENDIX E

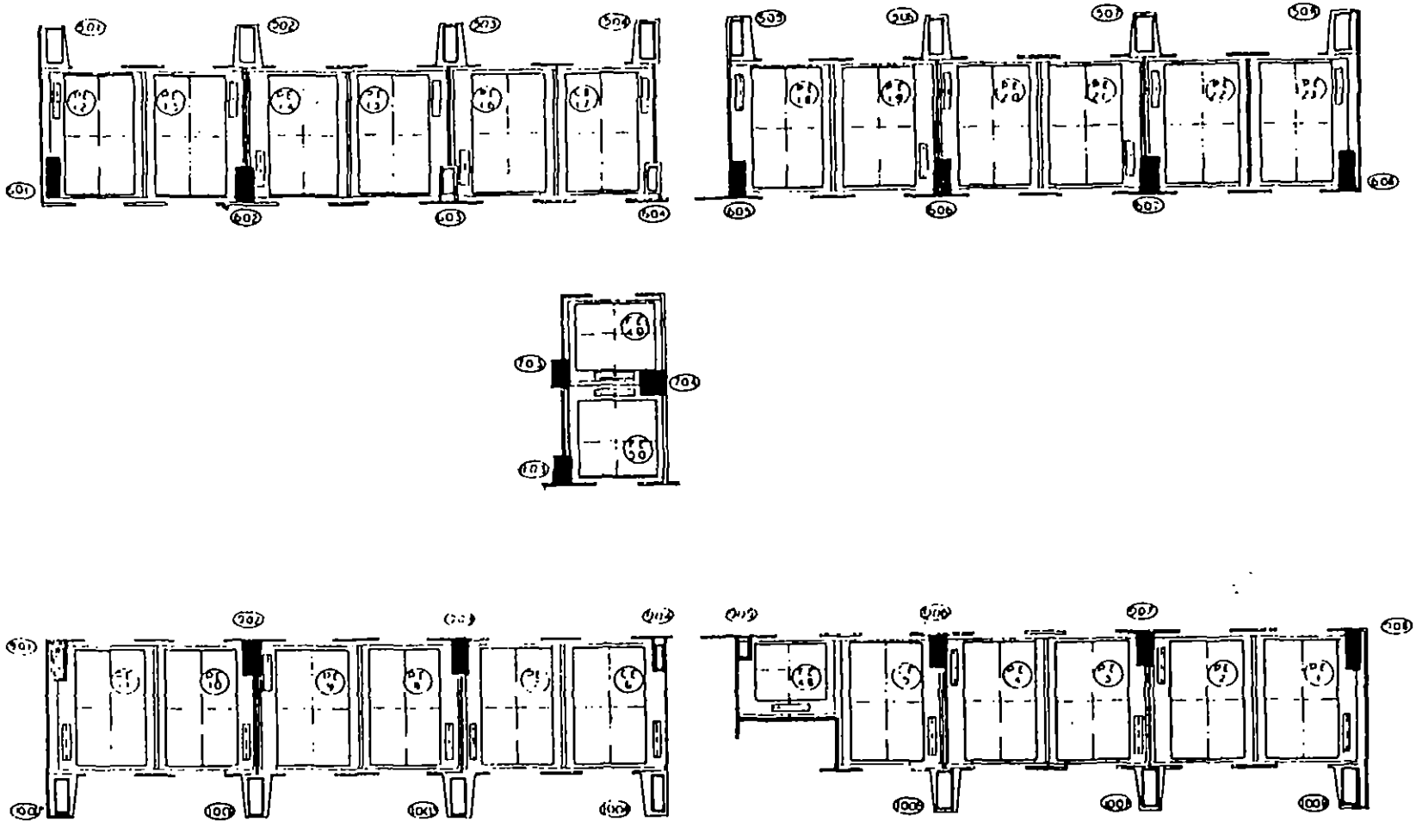
E.1 FIGURES OF TOWER ONE

INDICATES COLUMNS INSPECTED IN THIS REPORT

INDICATES COLUMNS INSPECTED IN PAST REPORT

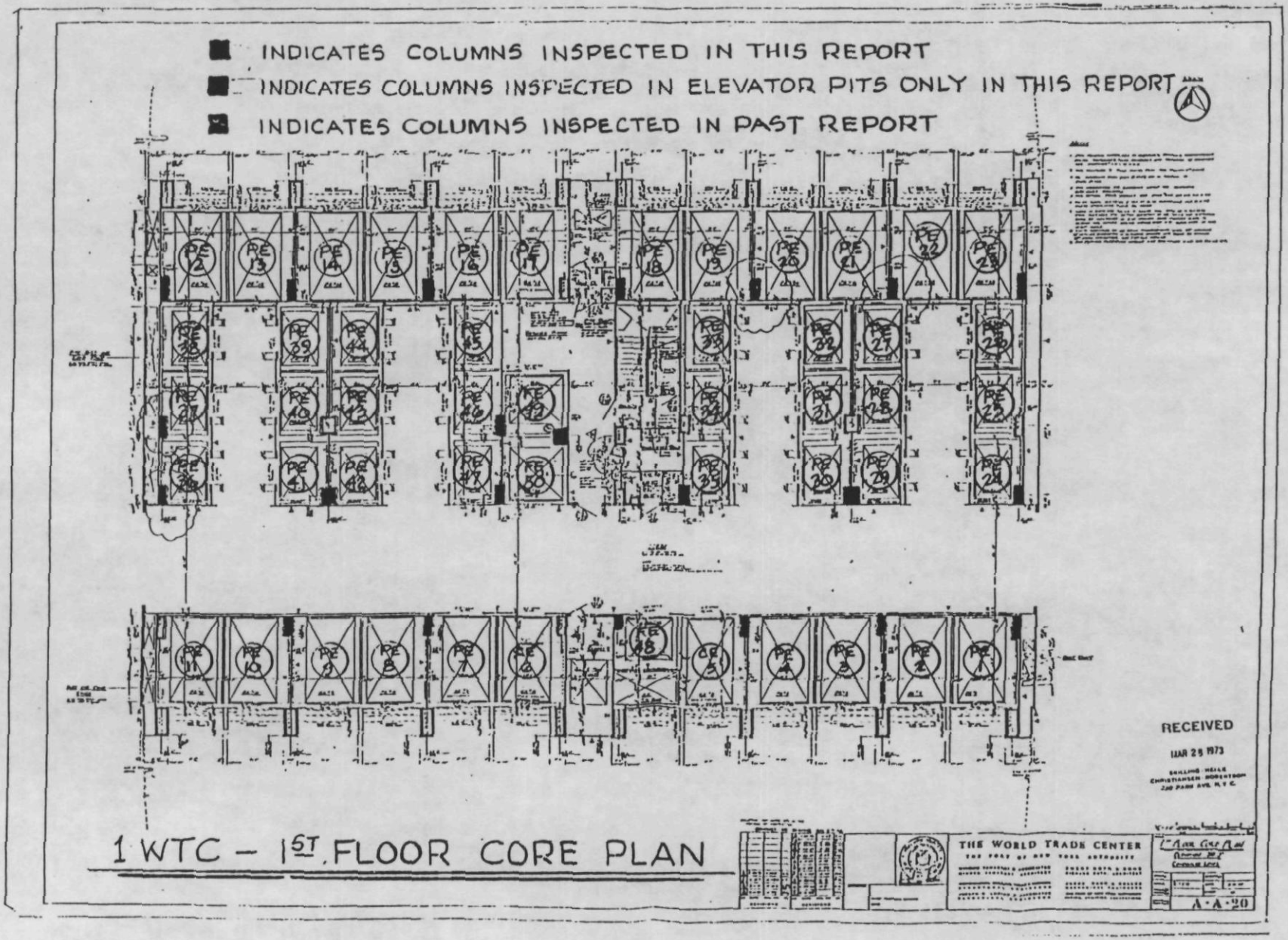
NORTH

LERA



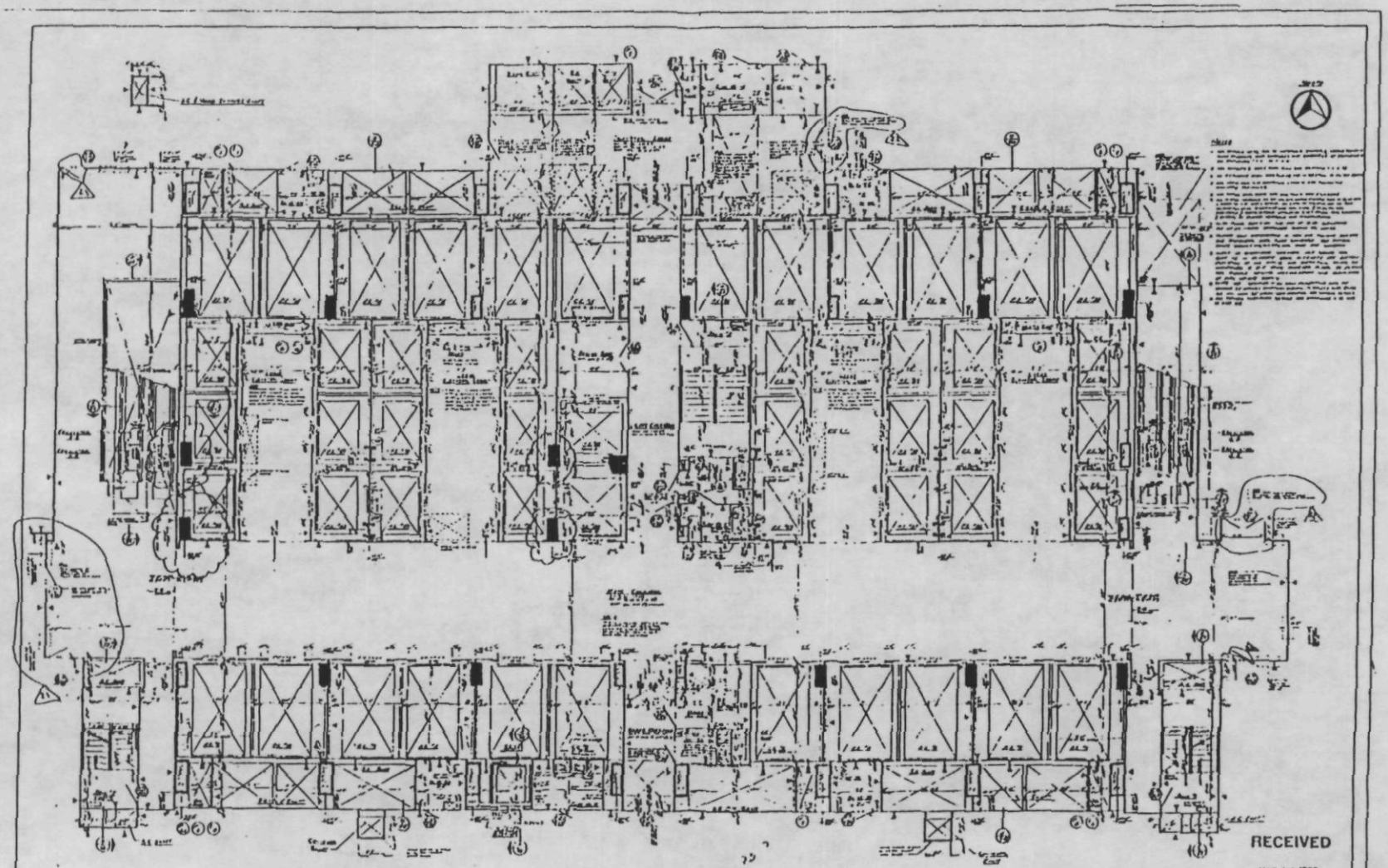
1 WTC – PLOT PLAN SHUTTLE AND FREIGHT ELEVATORS

LERA



1 WTC – 1ST. FLOOR CORE PLAN

LERA



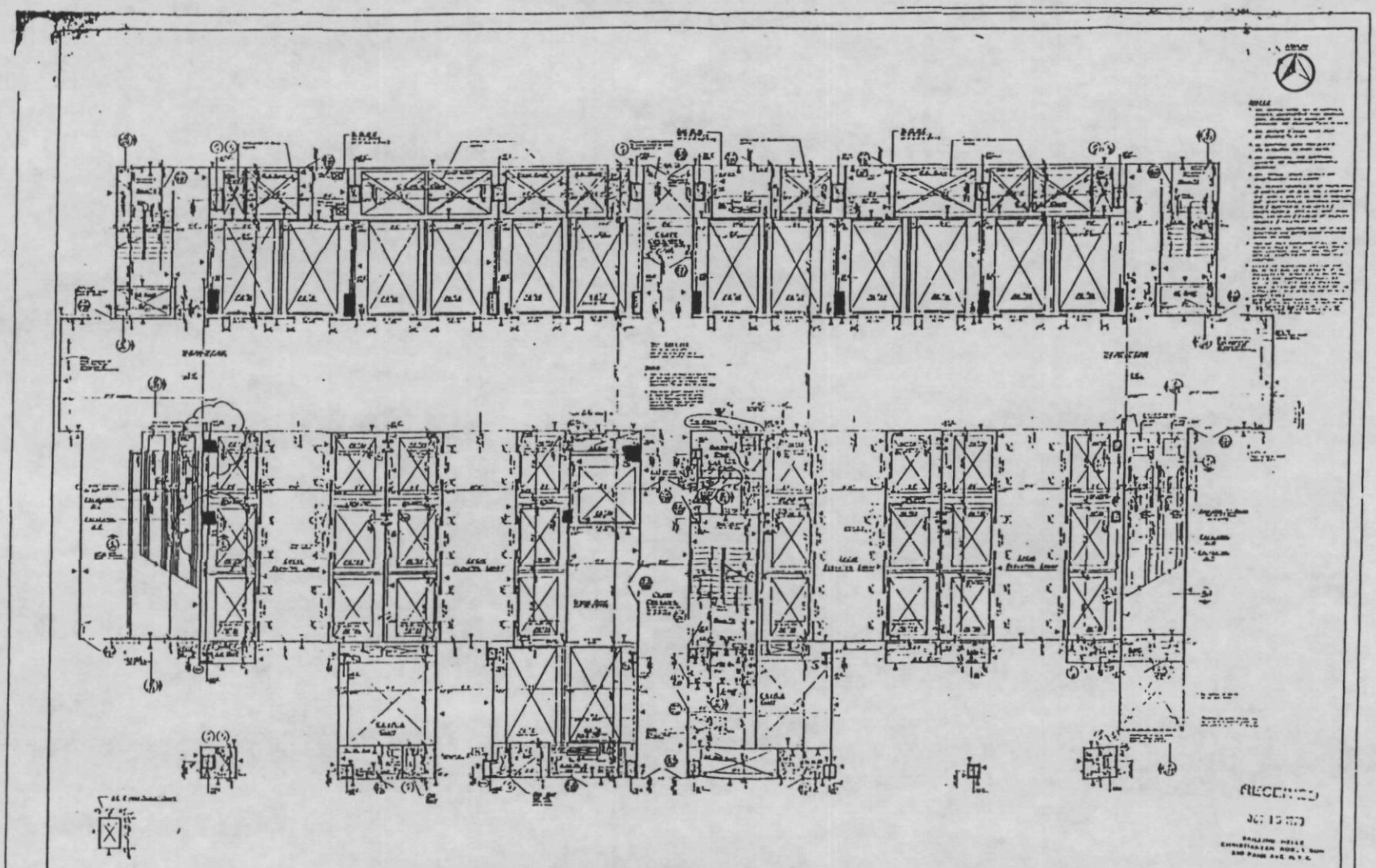
RECEIVED
MAR 14 1972

1 WTC – 44TH FLOOR CORE PLAN

THE WORLD TRADE CENTER

A-A-75

LERA



1 WTC – 78TH FLOOR CORE PLAN

THE WORLD TRADE CENTER

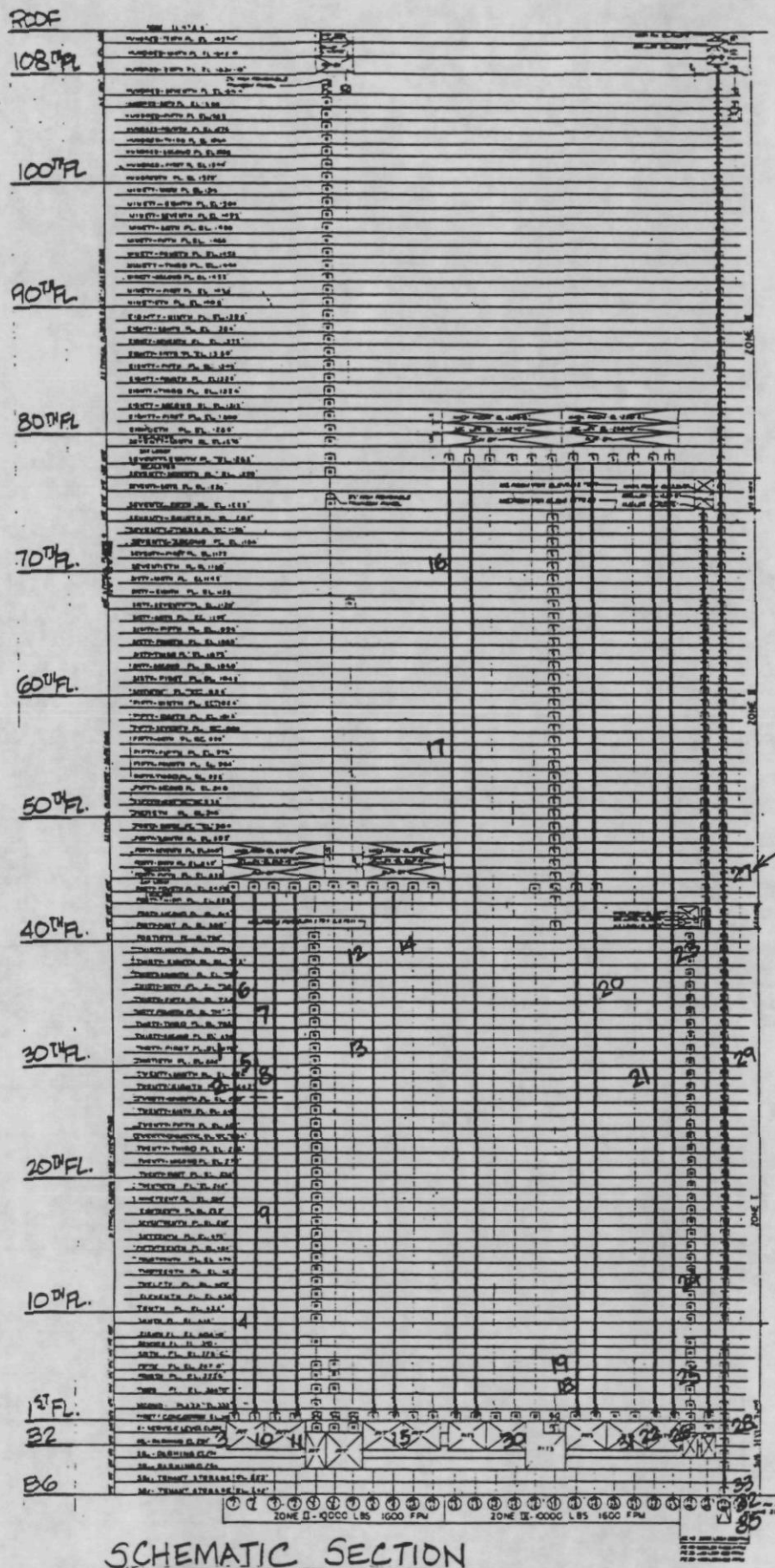
A-A-151

LERA

APPENDIX E

E.2 SCHEMATIC SECTION
SHUTTLE & FREIGHT ELEVATORS
AT 1 WTC

LERA



INDICATES PHOTO #27

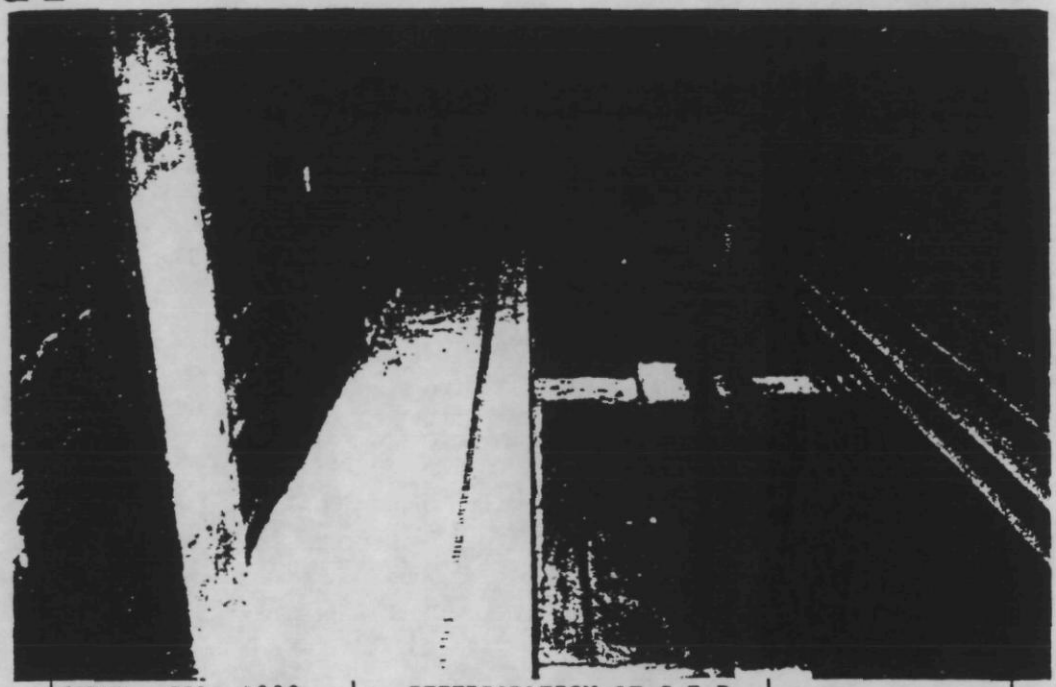
1 WTC

SCHEMATIC SECTION
SHUTTLE & FREIGHT ELEVATORS

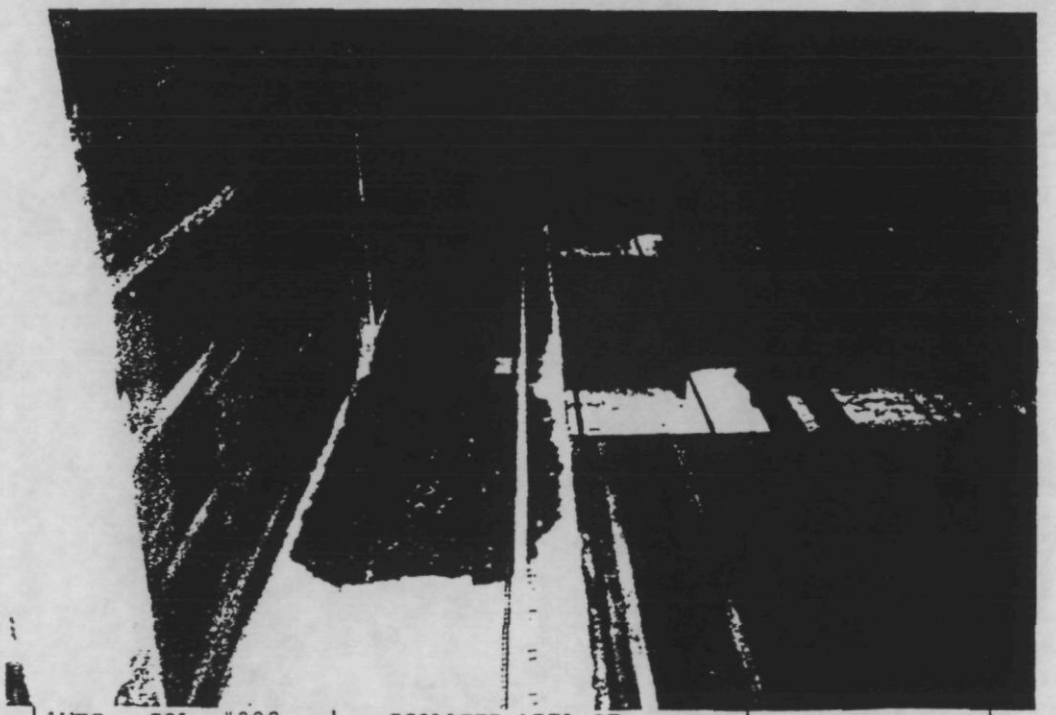
APPENDIX E

E.3 PHOTOGRAPHS OF TOWER ONE

LERA

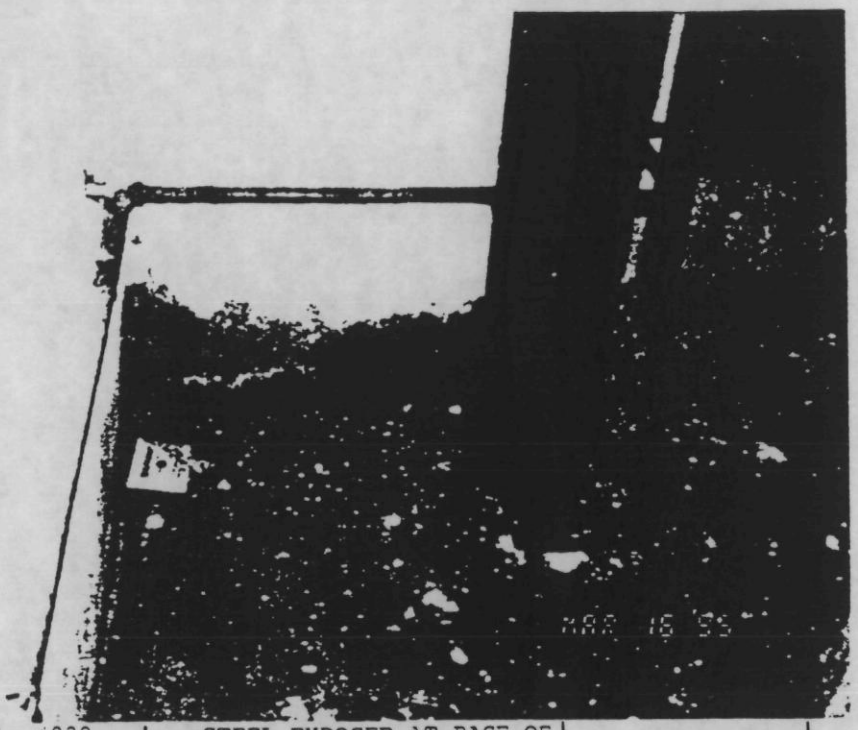


1	1WTC - COL. #908 ELEV. SHAFT #1A FLOOR 31 LOOKING UP TYPICAL 2ND-44TH	• DETERIORATION OF S.F.P. AT CONNECTING BEAMS • STEEL EXPOSED AT THE BOTTOM FLANGE OF CONNECTING BEAMS • STEEL EXPOSED AT THE EAST FACE OF COLUMN AT CONNECTING BEAMS	FP1	3

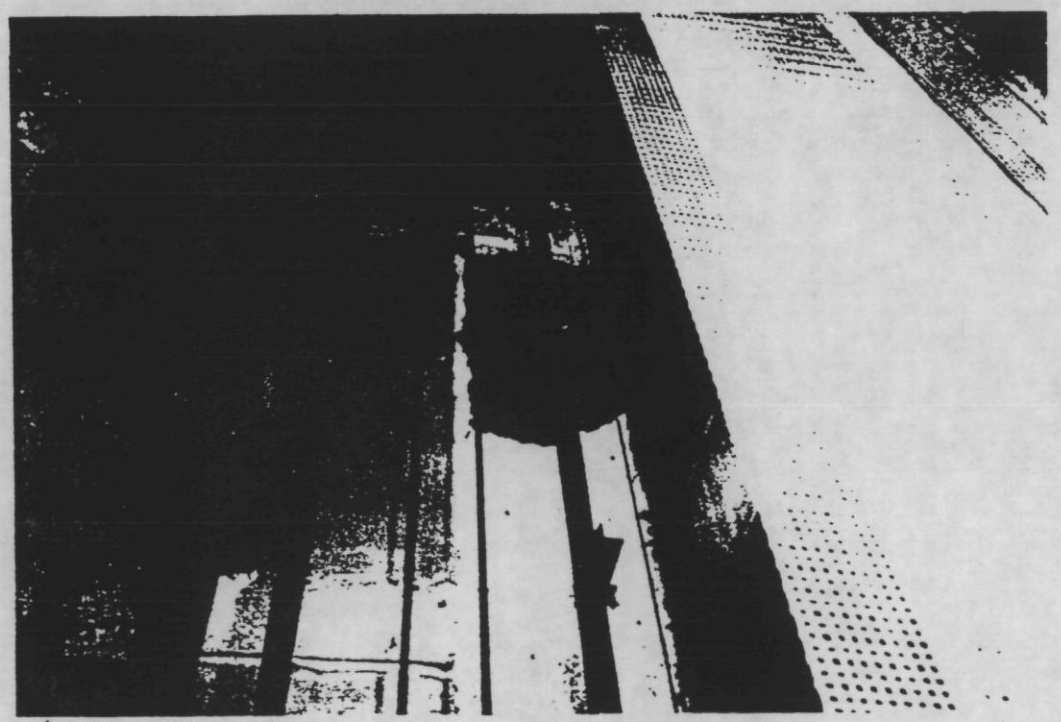


2	1WTC - COL. #908 ELEV. SHAFT #1A BTWN. 27TH-29TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2

LERA

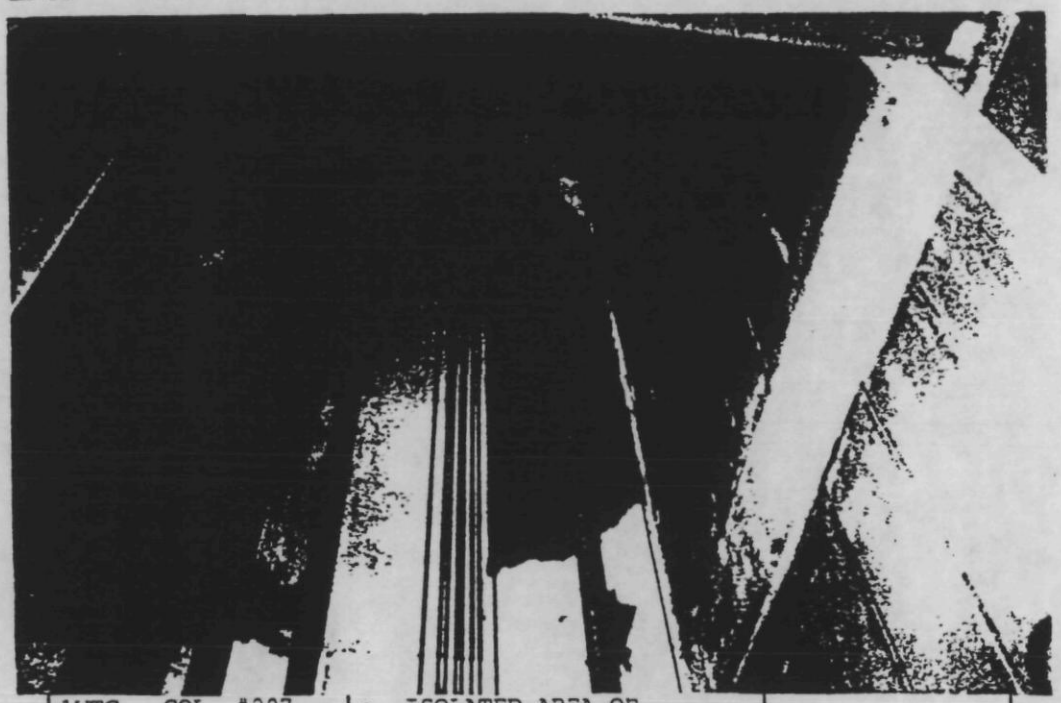


3	1WTC - COL. #908 ELEV. PIT # 1A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5

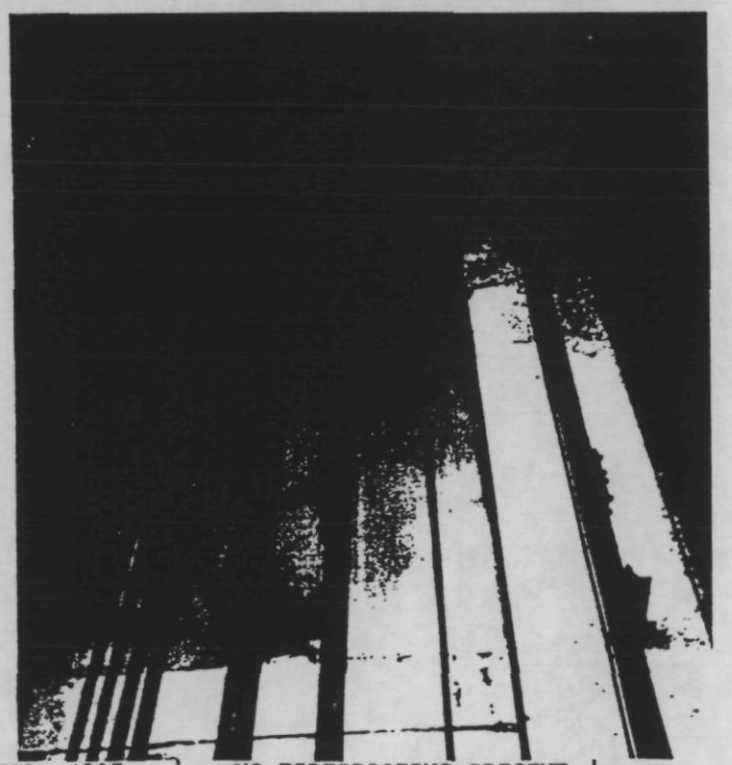


4	1WTC - COL. #907 ELEV. SHAFT #2A 9TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2,3

LERA

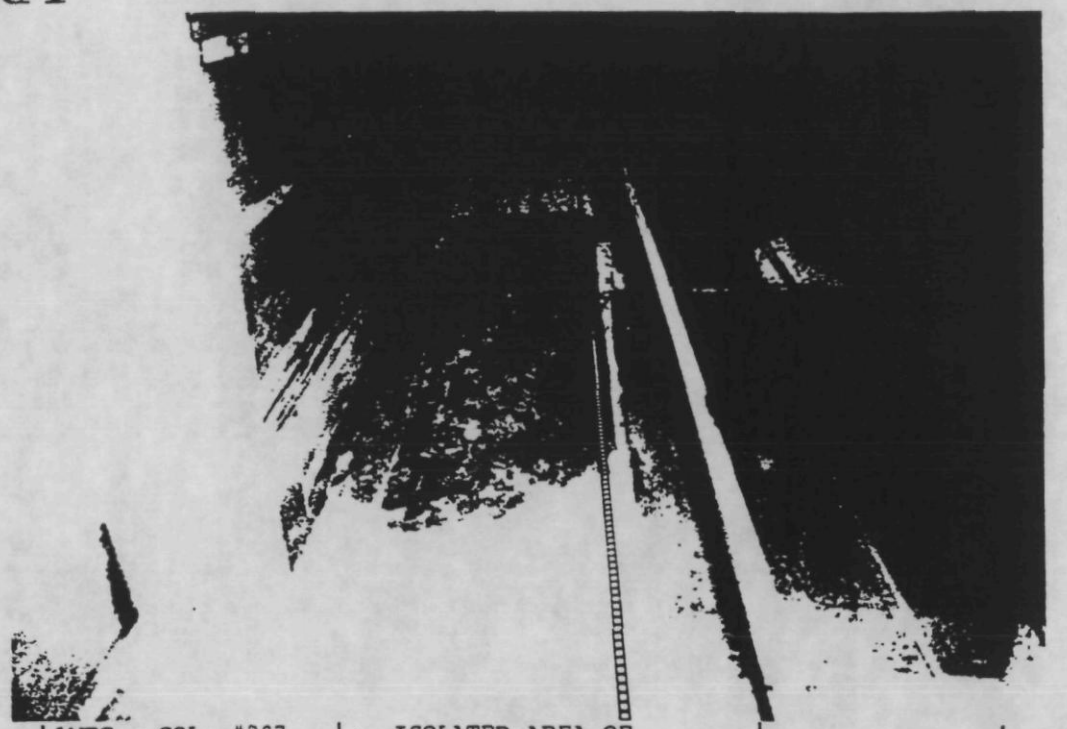


5	1WTC - COL. #907 ELEV. SHAFT #2A BTWN 30-31ST FL. SIMILAR CONDITION AT 34TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2

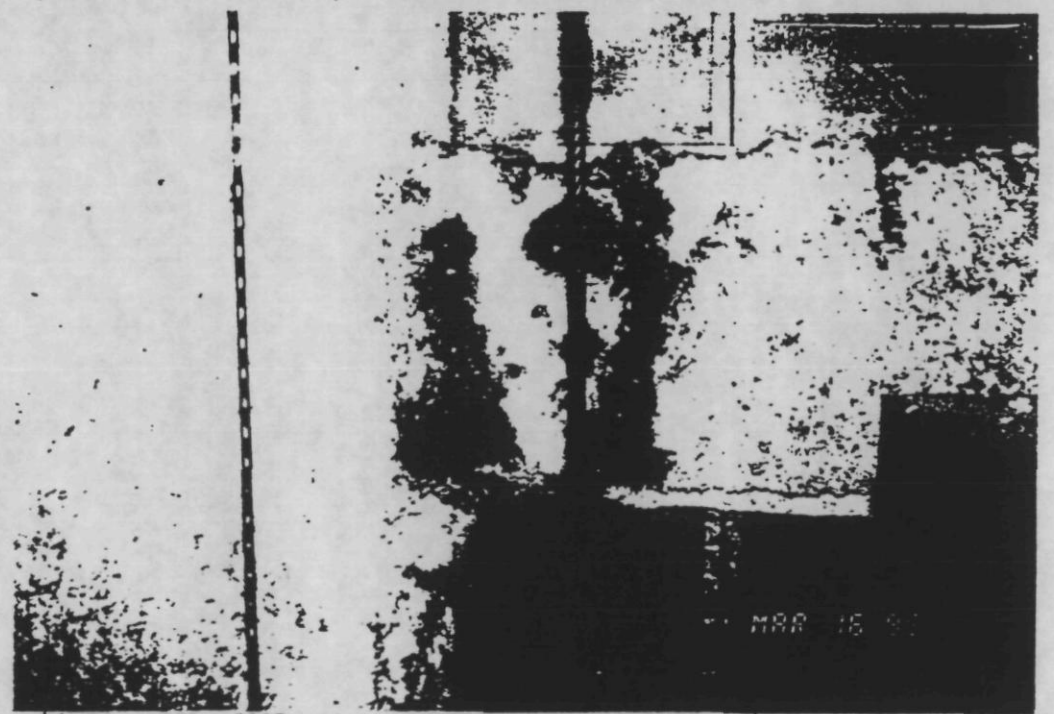


6	1WTC - COL. #907 ELEV. SHAFT #2A 36TH, 37TH & 38TH FLOOR	• NO FIREPROOFING PRESENT AT CONNECTING BEAMS • LIGHT SURFACE RUST	FP1	2

LERA

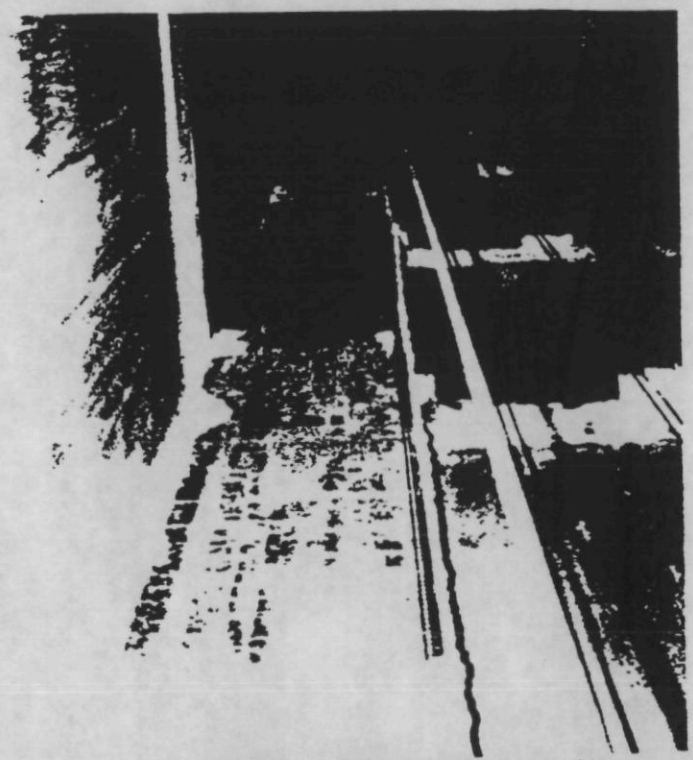


7	1WTC - COL. #907 ELEV. SHAFT #3A 34TH FLOOR SIMILAR CONDITION AT 9TH & 28TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2

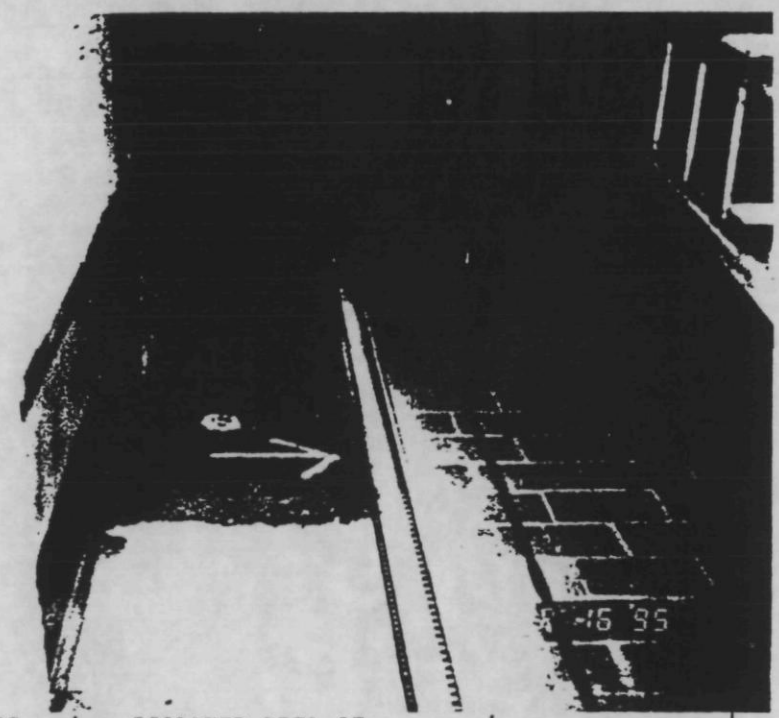


8	1WTC - COL. #907 ELEV. SHAFT #3A 29TH FLOOR	• MODERATE SURFACE RUST AT CONNECTION TO COLUMN • DETERIORATION OF S.F.P. • ONE BOLT WAS MISSING	FP1	3

LERA

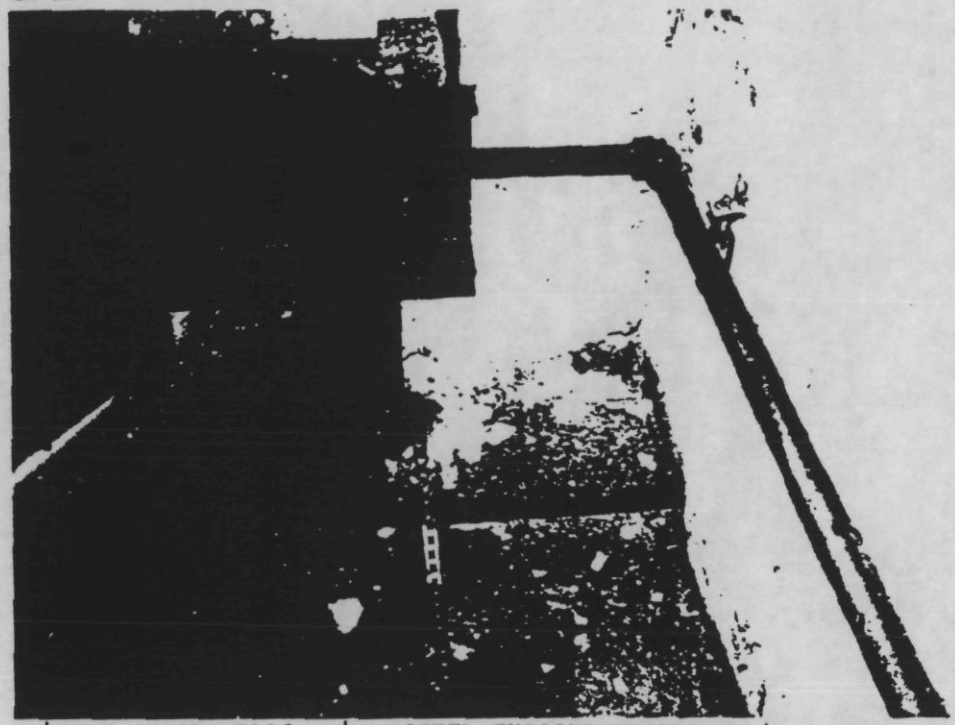


9	1WTC - COL. #907 ELEV. SHAFT #3A BTWN 16TH-20TH FLOOR	• LARGE AREA OF SPALLING FIREPROOFING • DETERIORATION OF S.F.P. AT CONNECTING BEAMS	FP1	2

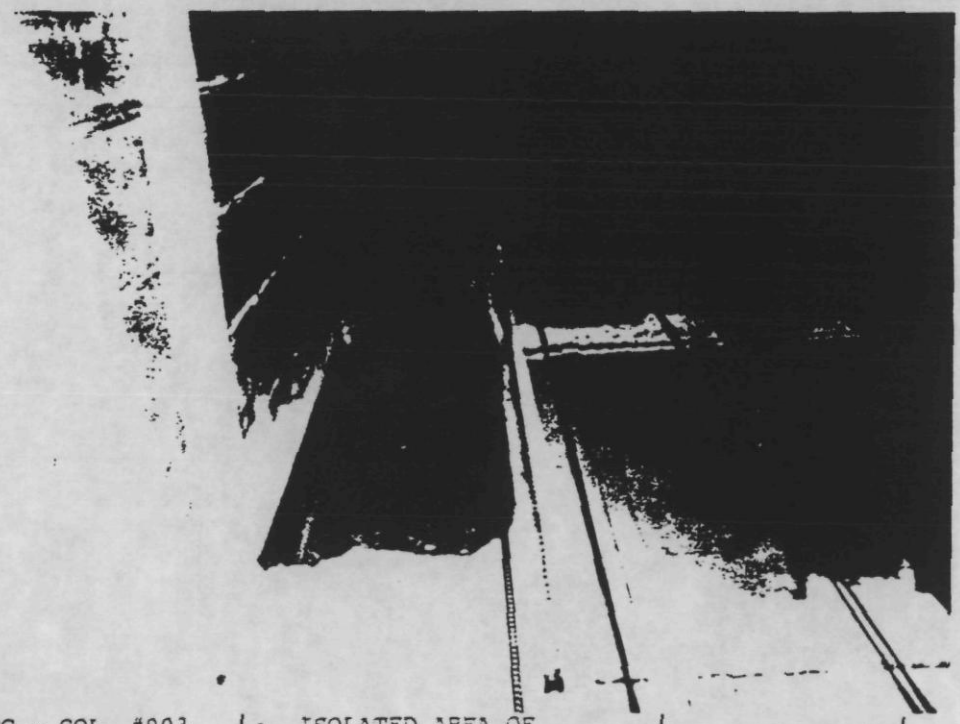


10	1WTC - COL. #907 ELEV. PIT #3A LEVEL B2	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2

LERA

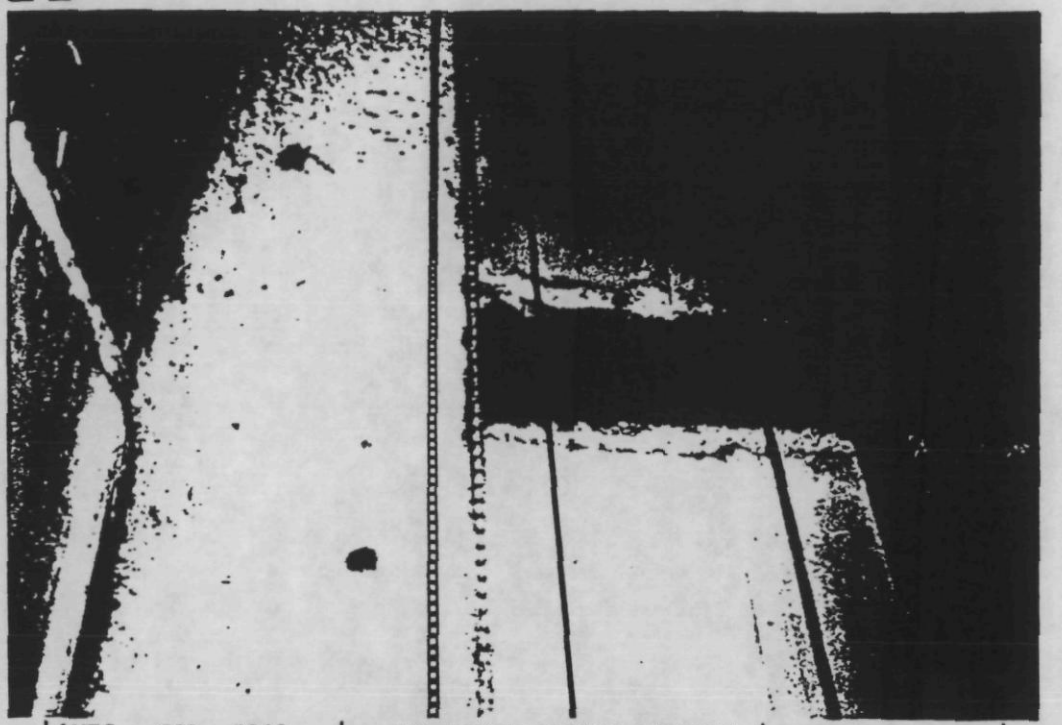


11	1WTC - COL. #906 ELEV. PIT #4A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP2	5

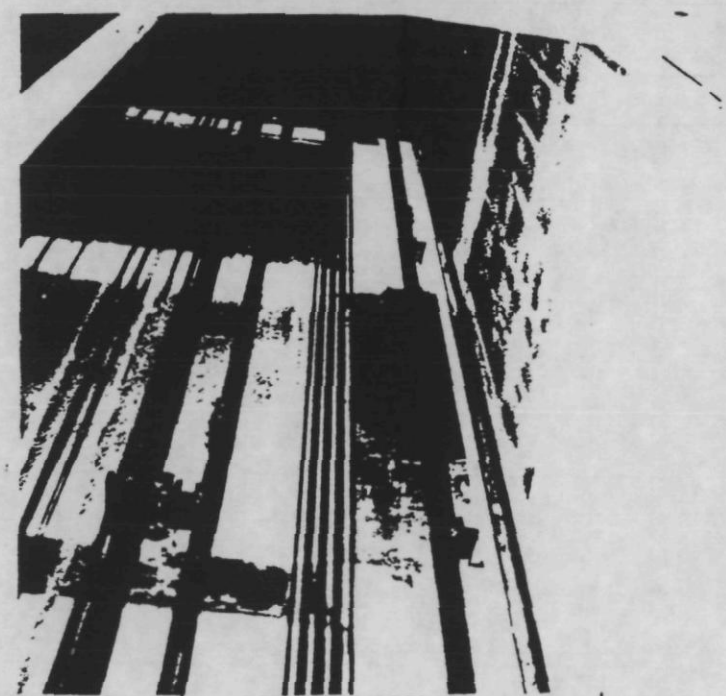


12	1WTC - COL. #903 ELEV. SHAFT #8A 38TH & 39TH FLOOR SIMILAR CONDITION AT 33RD, 34TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2,3

LERA

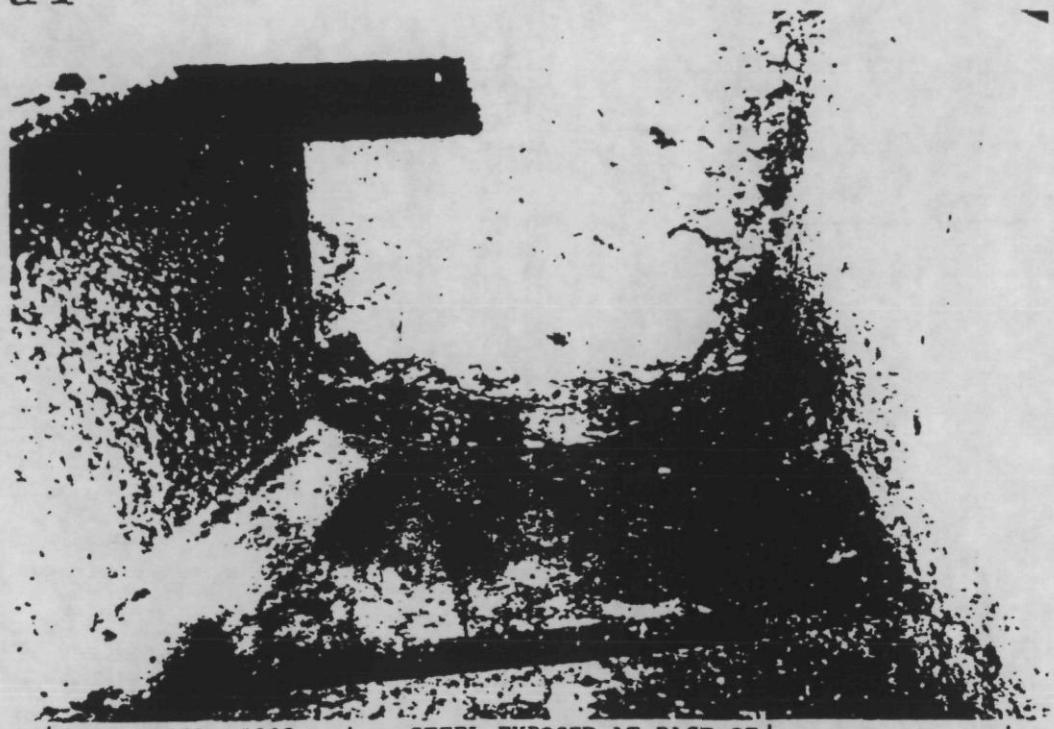


13	1WTC - COL. #903 ELEV. SHAFT #8A 31ST FLOOR	• NO FIREPROOFING PRESENT AT CONNECTING BEAMS • LIGHT SURFACE RUST	FP1	2

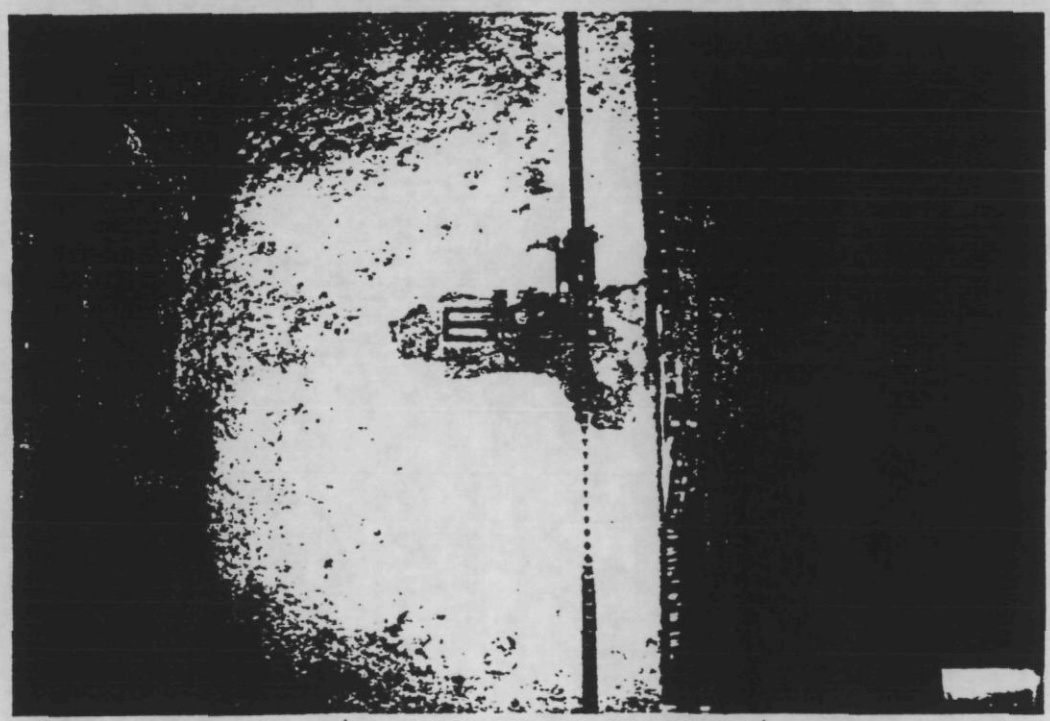


14	1WTC - COL. 902 ELEV. SHAFT #9A 39TH & 41ST FLOOR SIMILAR CONDITION AT 43RD FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2

LERA

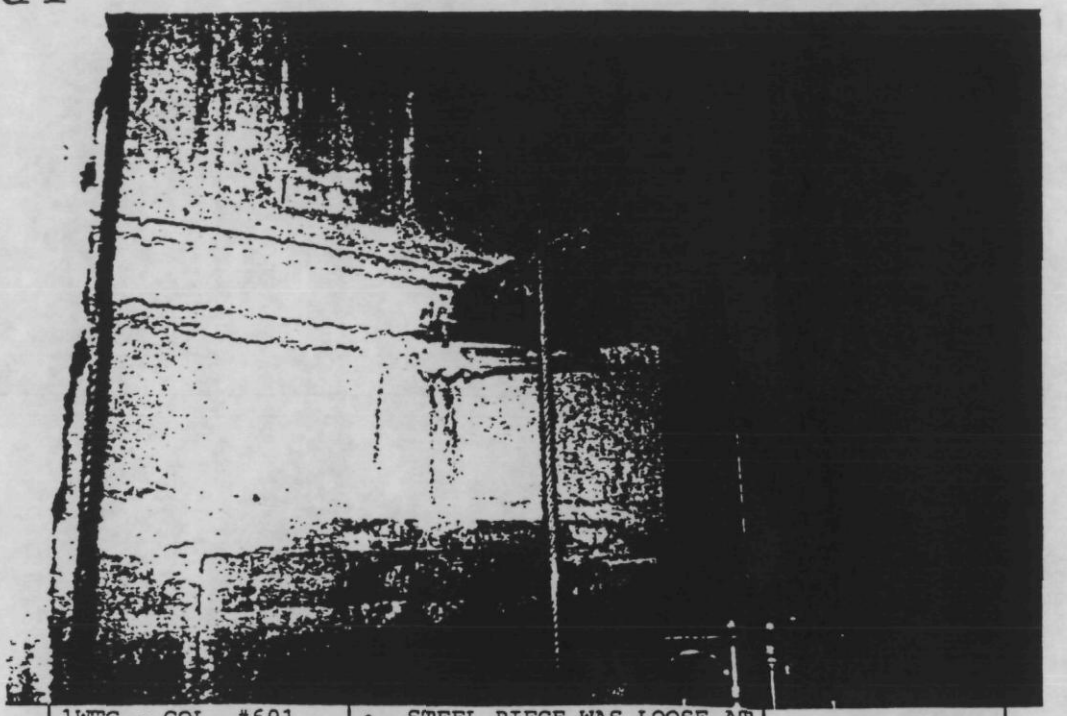


15	1WTC - COL. #902 ELEV. PIT #9A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5

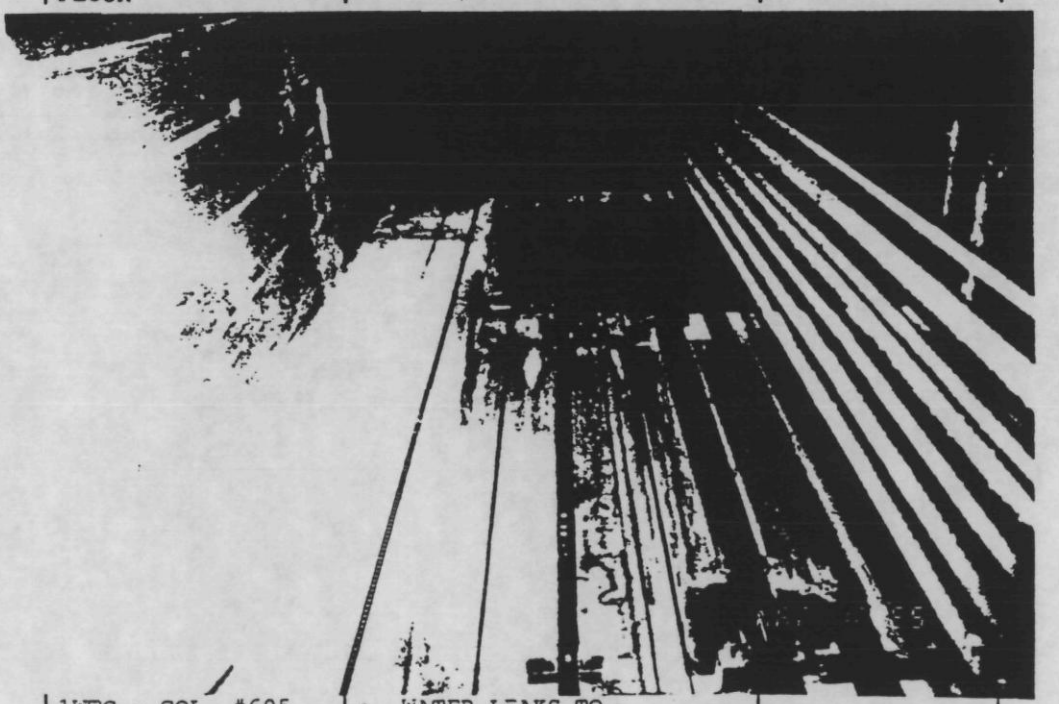


16	1WTC -COL. #601 ELEV. SHAFT #12A 70TH FLOOR TYPICAL AT ALL ELEVATOR SHAFTS	• STEEL EXPOSED AT SUPPORT BRACKET FOR HOIST CABLE	FP1	3

LERA

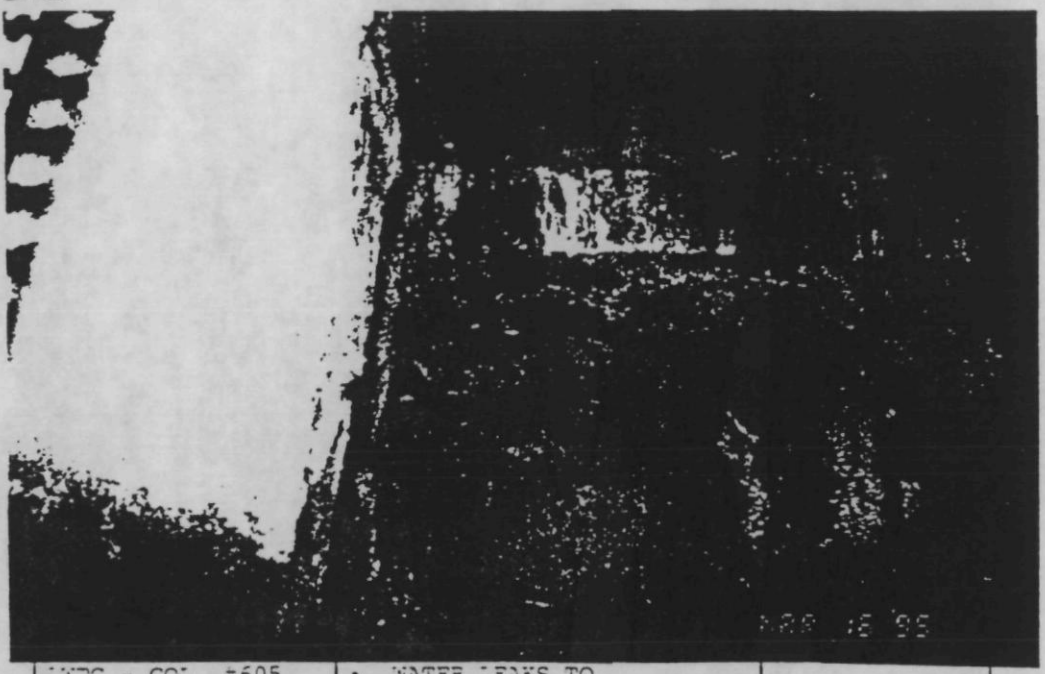


17	1WTC - COL. #601 ELEV. SHAFT & 12A 55TH FLOOR TYPICAL 2ND-78TH FLOOR	• STEEL PIECE WAS LOOSE AT SUPPORT BRACKET	FP1	6,4



18	1WTC - COL. #605 ELEV. SHAFT #18A 3RD-5TH FLOOR	• WATER LEAKS TO FIREPROOFING ENVELOP AND CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS WITHIN 5 FOOT FROM COLUMN • MODERATE SURFACE RUST	FP2	3,4

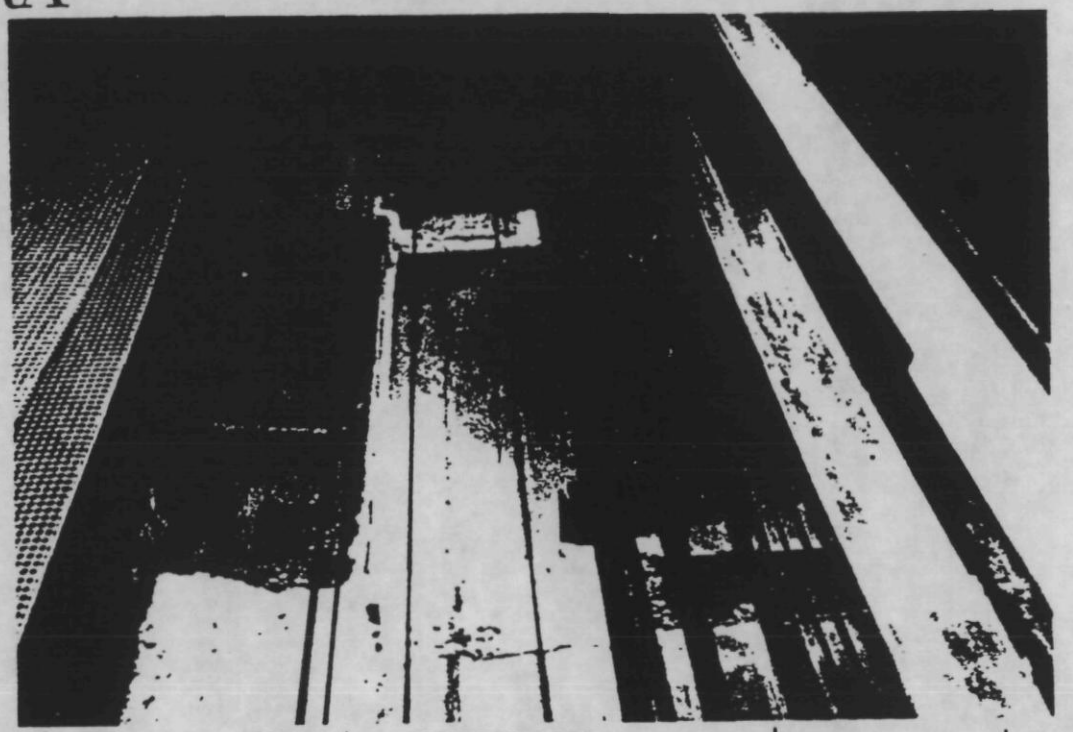
LERA



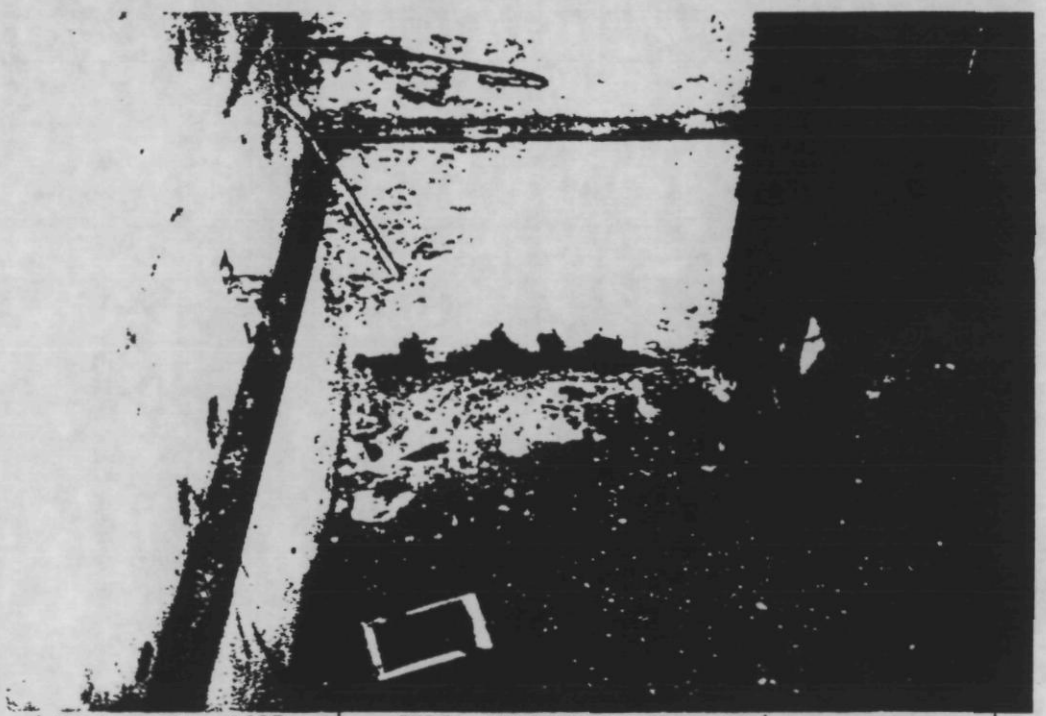
19	1WTC - COL. #605 ELEV. SHAFT #18A 3RD-5TH FLOOR	• WATER LEAKS TO FIREPROOFING ENVELOP AND CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS WITHIN 5 FOOT FROM COLUMN • MODERATE SURFACE RUST	FP2	5

20	1WTC - COL. #606 ELEV. SHAFT #19A 35TH - 39TH FLOOR SIMILAR CONDITION AT 8TH, 11TH, 19TH & 25TH-30TH FLOOR, 43RD-45TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	1

LERA

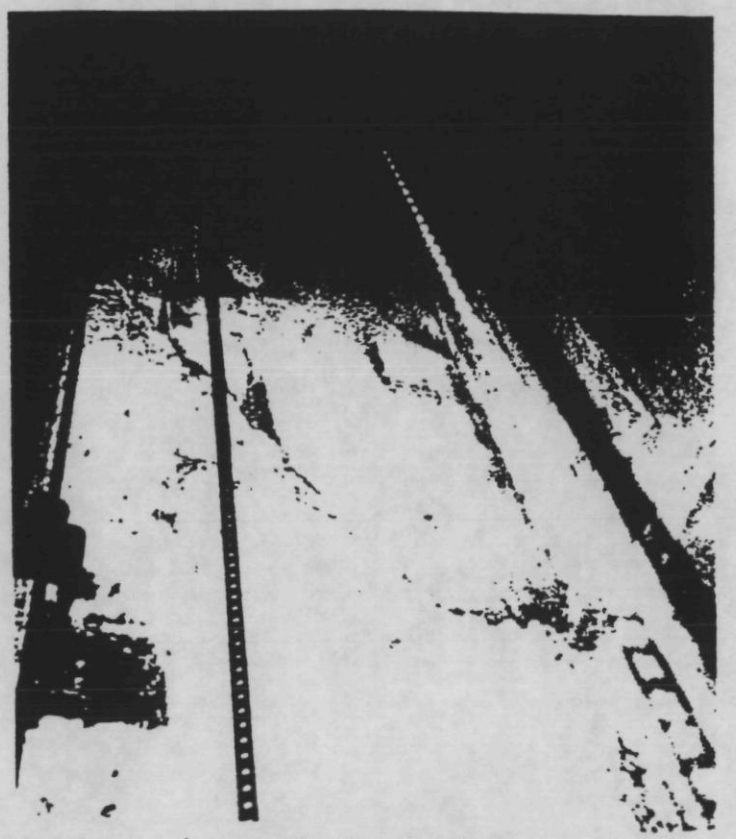


21	1WTC - COL. #607 ELEV. SHAFT #22A 28TH-30TH FLOOR TYPICAL 2ND-78TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING FROM COLUMN AND CONNECTING BEAM • STEEL EXPOSED • LIGHT SURFACE RUST	FP1	2,3



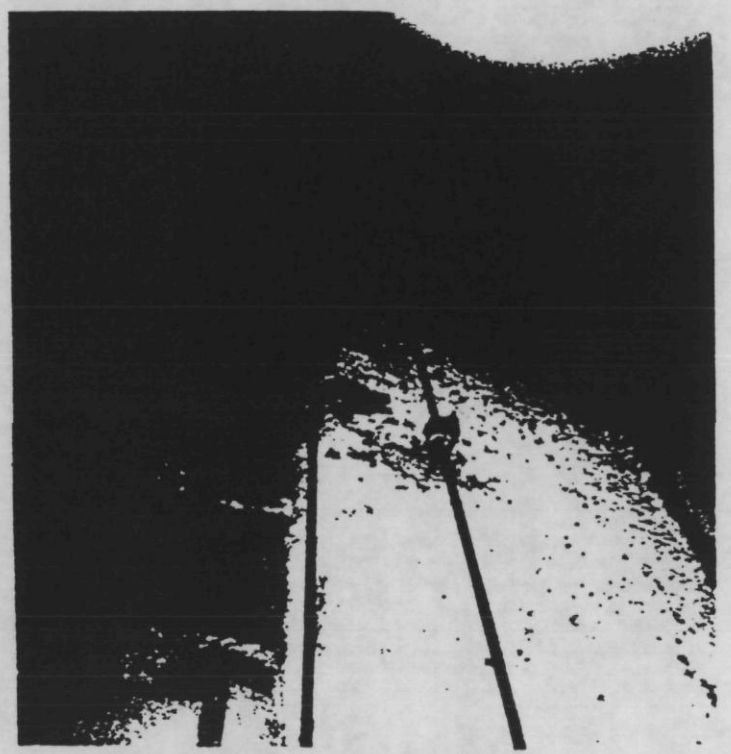
22	1WTC - COL. #607 ELEV. PIT #22A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5

LERA



23	1WTC - COL. #608 ELEV. SHAFT #23A 39TH FLOOR SIMILAR CONDITION AT 78TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • STEEL EXPOSED AT SUPPORT BRACKET FOR HOIST CABLE, TYPICAL CONDITION AT ALL FLOORS	FP1	2

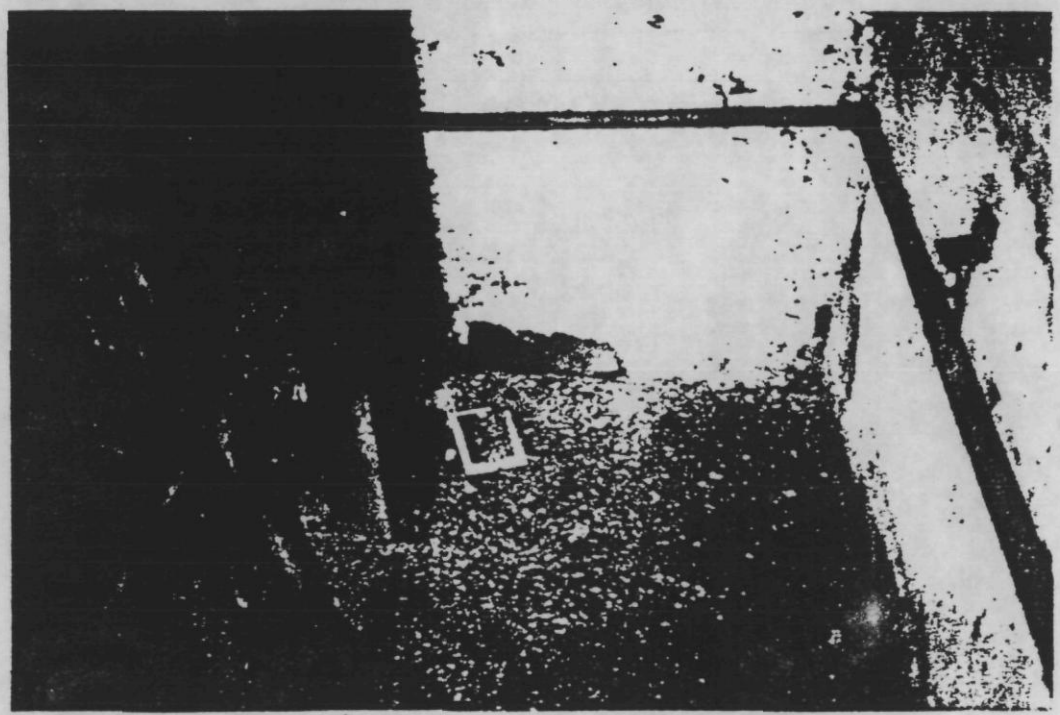
LERA



24	1WTC - COL. #608 ELEV. SHAFT #23A FLOOR 12TH LOOKING UP TYPICAL 2ND-78TH FLOOR	• DETERIORATION OF S.F.P. ALONG THE LENGTH OF THE COLUMN AND ITS CONNECTING BEAMS • STEEL EXPOSED AT THE SUPPORT BRACKET FOR HOIST CABLE	FP1	3

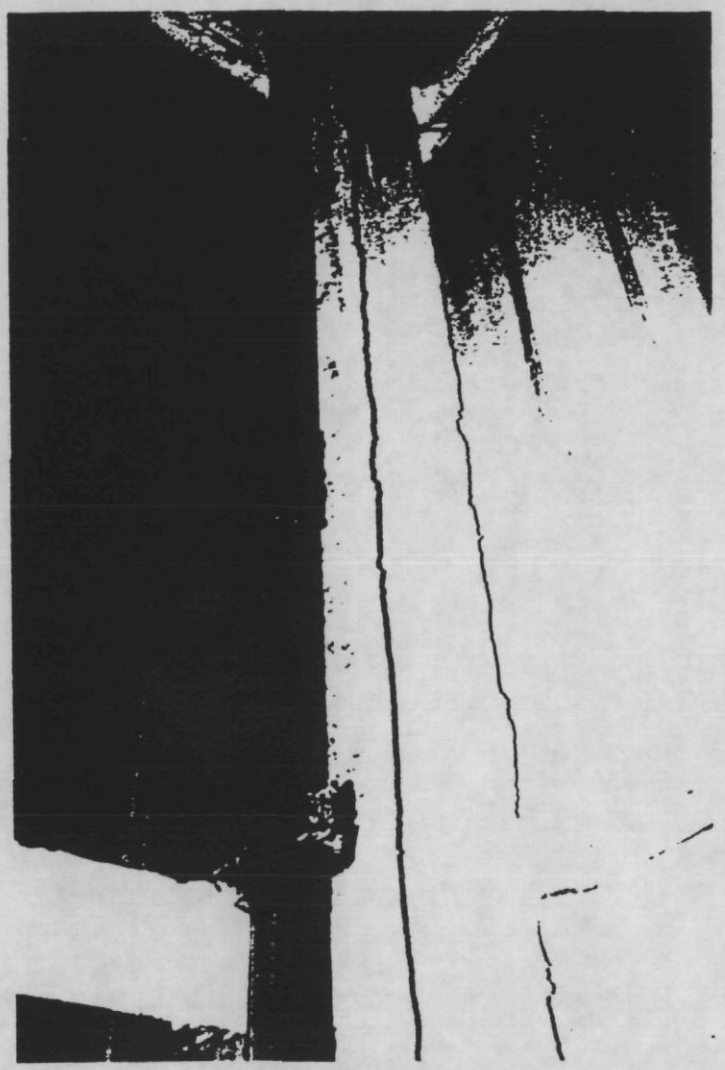
LERA

25	1WTC - COL. #608 ELEV. SHAFT #23A 4TH FLOOR TYPICAL 2ND-7STH FLOOR	• DETERIORATION OF S.F.P. AT TOP FLANGE OF CONNECTING BEAMS • STEEL EXPOSED WITHIN 3 FOOT FROM COLUMN • MODERATE SURFACE RUST OBSERVED AT TOP FLANGE OF CONNECTING BEAM	FP1	3



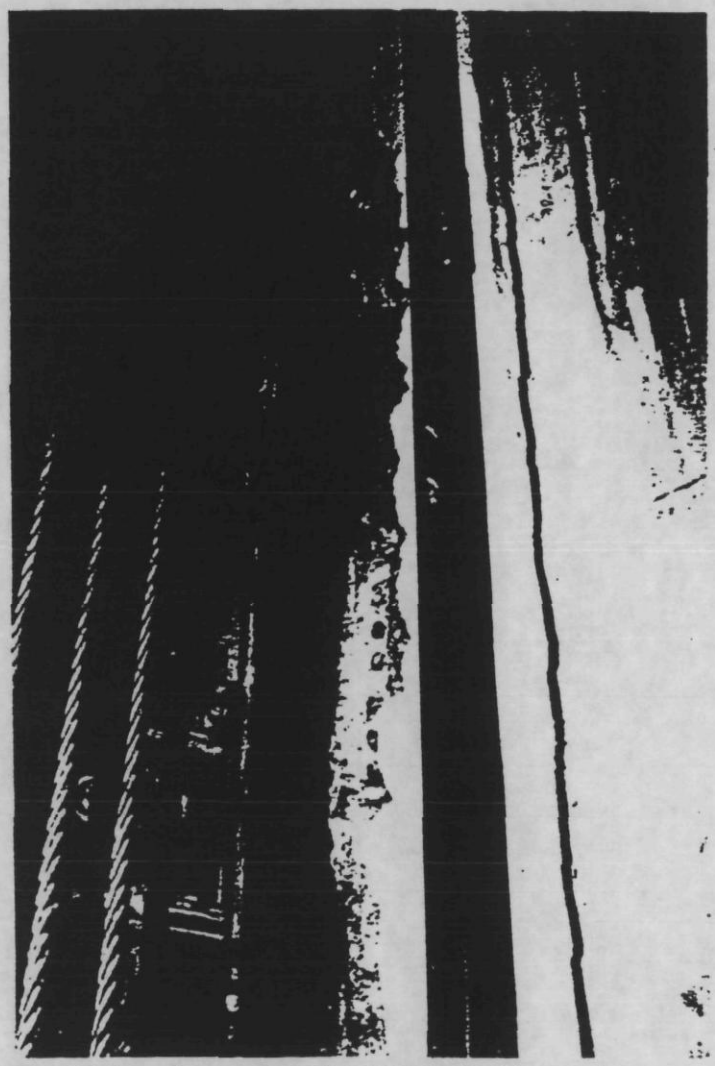
26	1WTC - COL. #608 ELEV. PIT #23A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	3

LERA



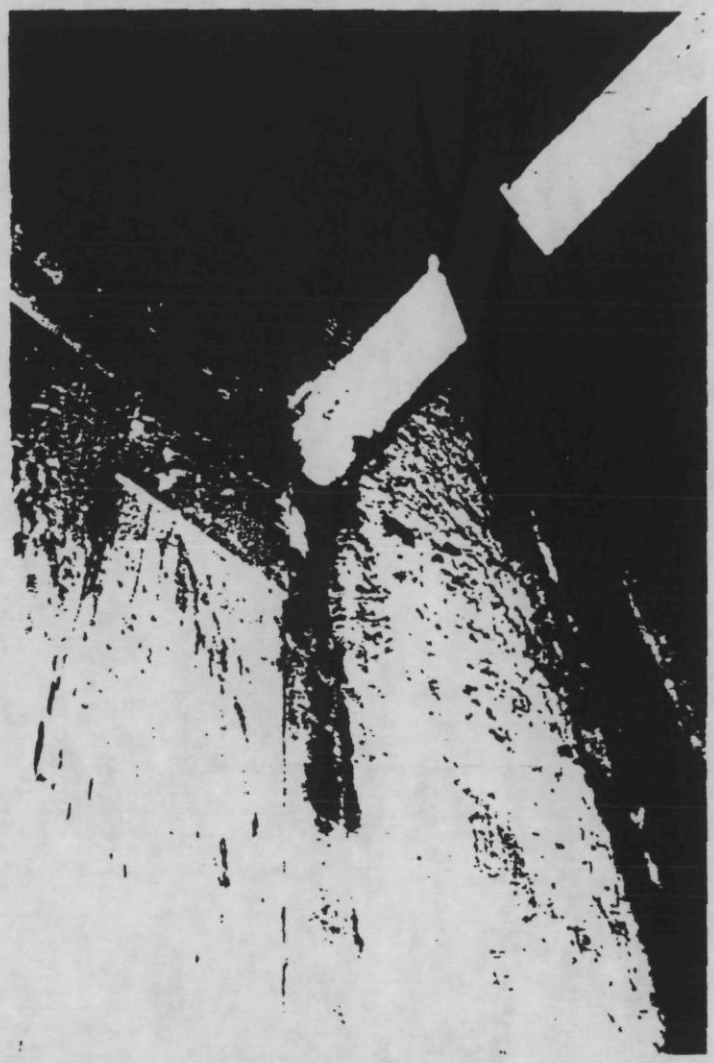
27	1WTC - COL. #704 ELEV. SHAFT #50A 45TH FLOOR TYPICAL B2-78TH FLOOR	• DETERIORATION OF S.F.P. ALONG THE LENGTH OF THE COLUMN • STEEL EXPOSED • LIGHT SURFACE RUST AT EDGE OF COLUMN	FP2	3

LERA



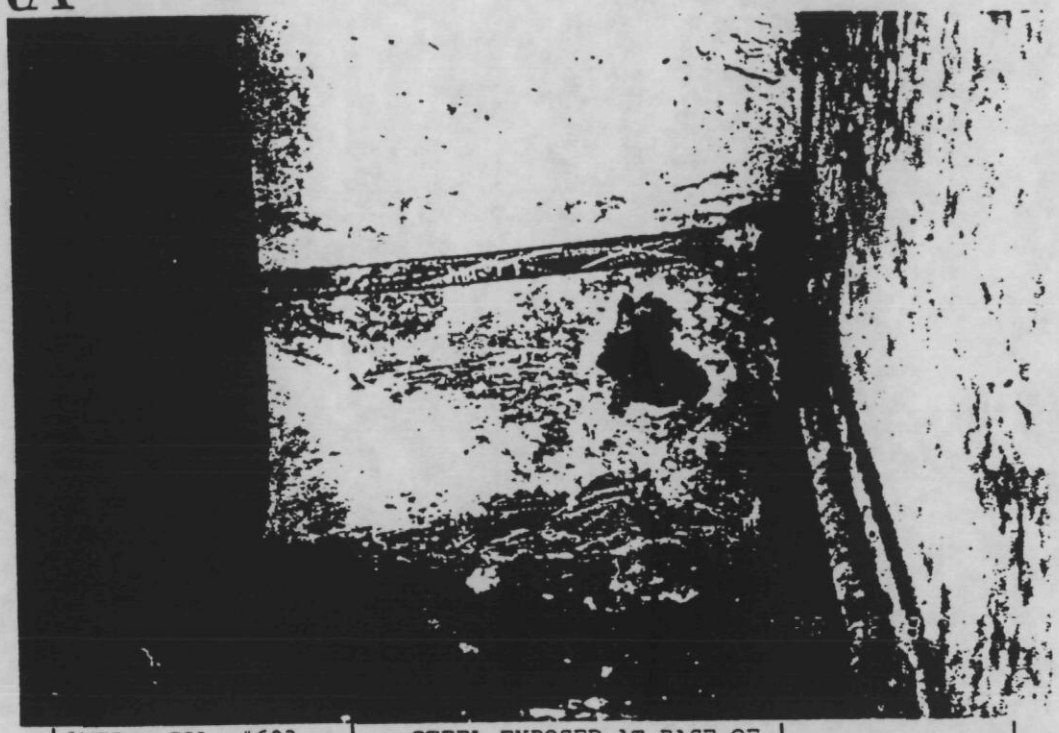
28	1WTC - COL. #704 ELEV. SHAFT #50A LEVEL B1	• EDGE OF COLUMN FLANGE EXPOSED • COLUMN SPLICE EXPOSED • LIGHT SURFACE RUST	FP2	2,3

LERA

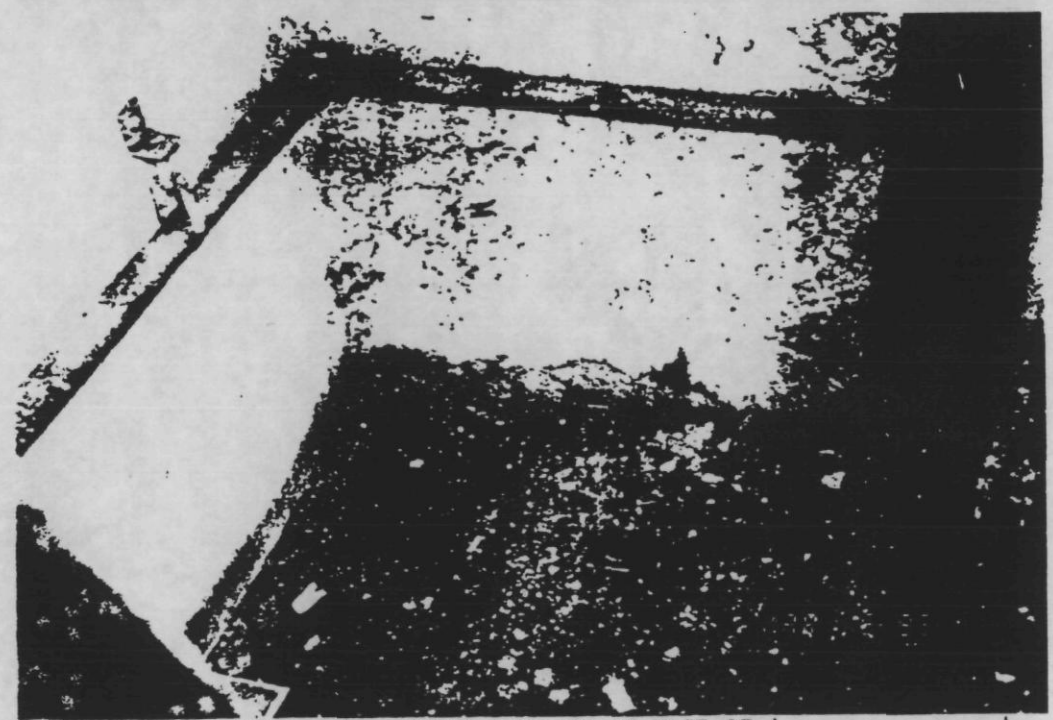


29	1WTC - COL. #703 ELEV. SHAFT #50A 30TH FLOOR TYPICAL B1~78TH FLOOR	• DETERIORATION OF S.F.P. ALONG THE LENGTH OF THE COLUMN • STEEL EXPOSED ALONG THE EDGE OF THE COLUMN • LIGHT SURFACE RUST	FP1	2

LERA

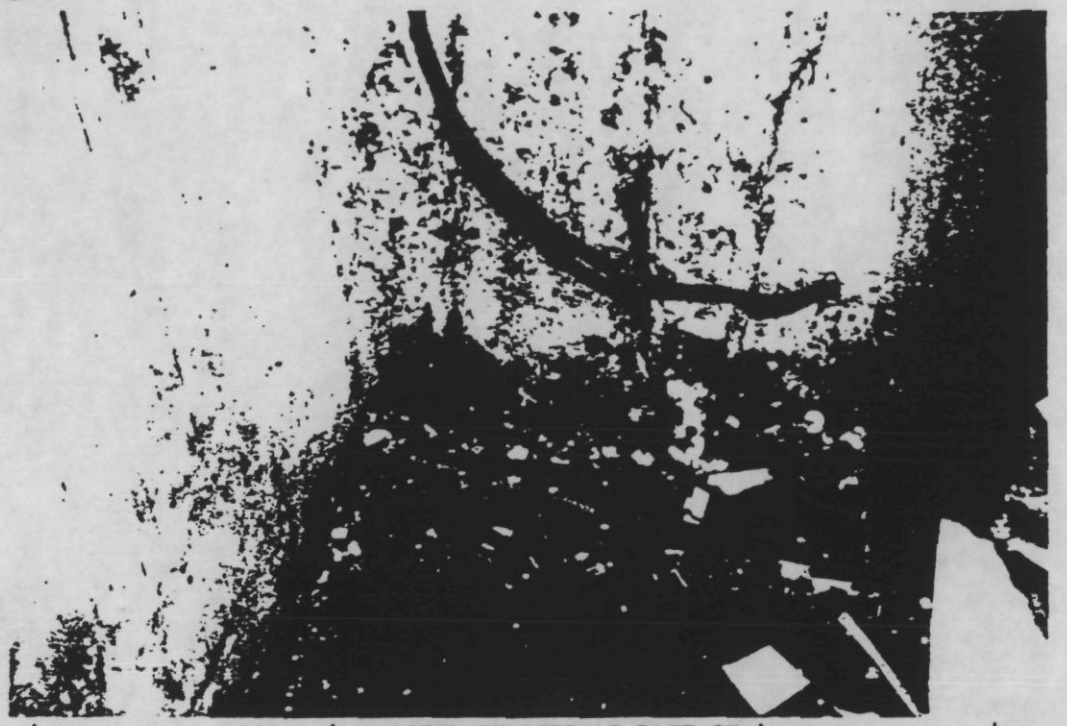


30	1WTC - COL. #603 ELEV. PIT #15A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP2	5

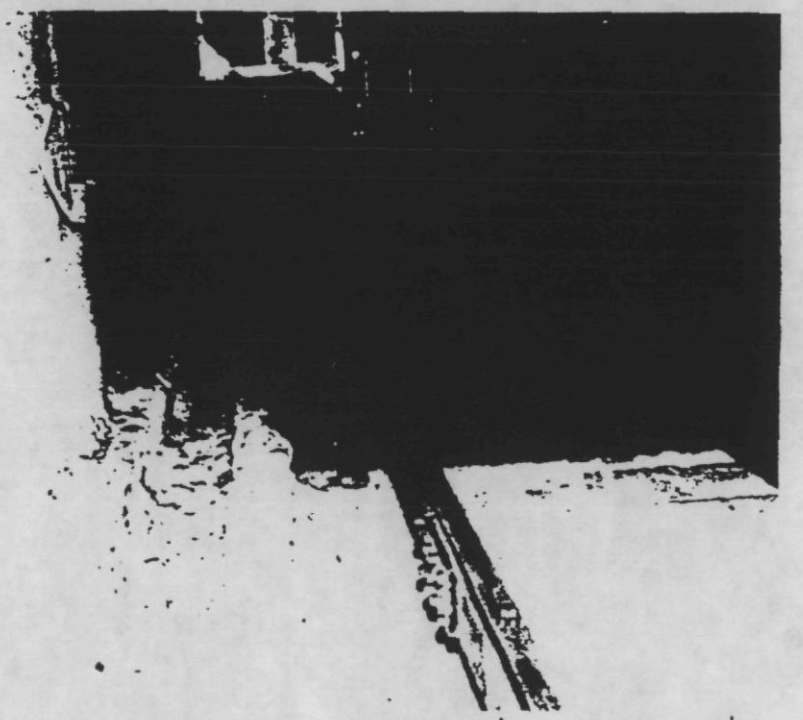


31	1WTC - COL. #606 ELEV. PIT #21A LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5

LERA



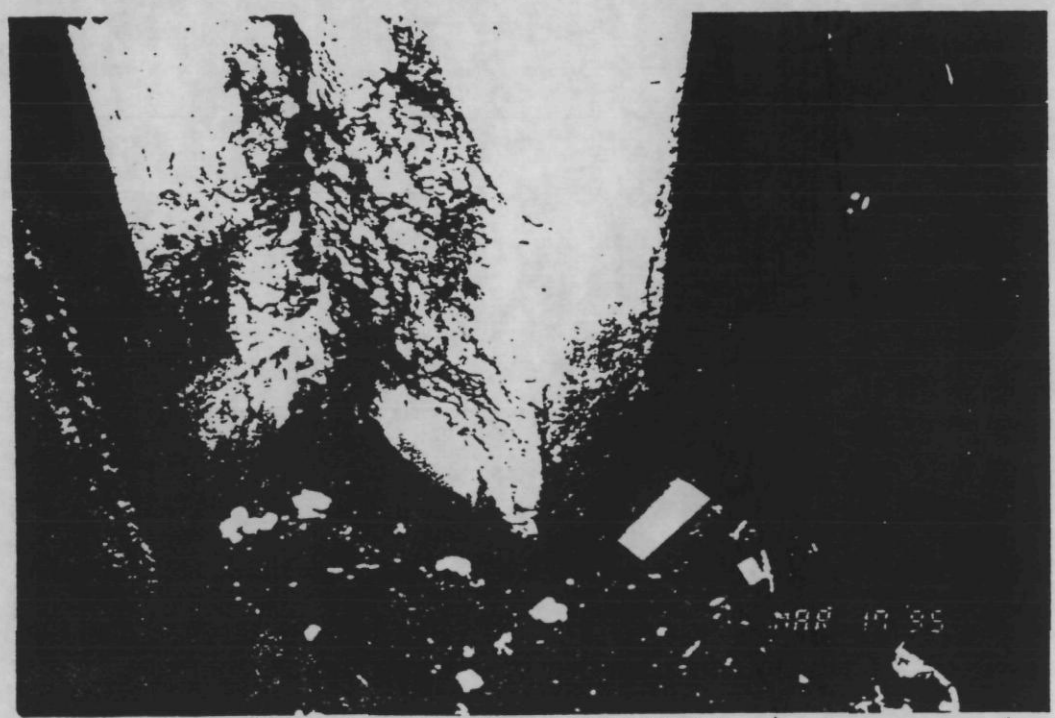
32	1WTC - COL. #704 ELEV. PIT #49A LEVEL B3	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5



33	1WTC - COL. #704 ELEV. PIT #49A LEVEL B3-B1	• DETERIORATION OF S.F.P. AT EDGE OF COLUMN • EDGE OF COLUMN EXPOSED • LIGHT SURFACE RUST	FP2	3

LERA

34	1WTC - COL. #802 ELEV. PIT #42A LEVEL B3	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5



35	1WTC - COL. #905 ELEV. PIT #48A LEVEL B3	• DAMAGE TO FIREPROOFING ENVELOP AT BASE OF COLUMN • STEEL EXPOSED • LIGHT TO MODERATE SURFACE RUST	FP2	5

APPENDIX F

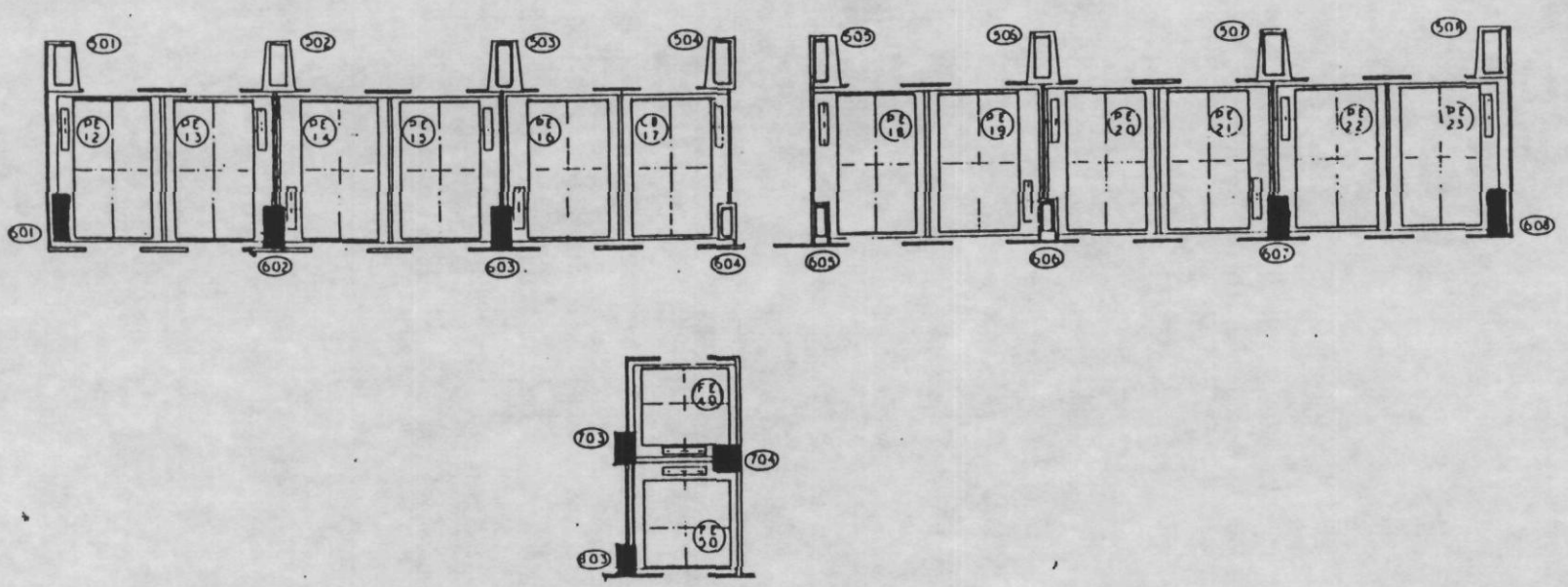
F.1 FIGURES OF TOWER TWO

INDICATES COLUMNS INSPECTED IN THIS REPORT

INDICATES COLUMNS INSPECTED IN PAST REPORT

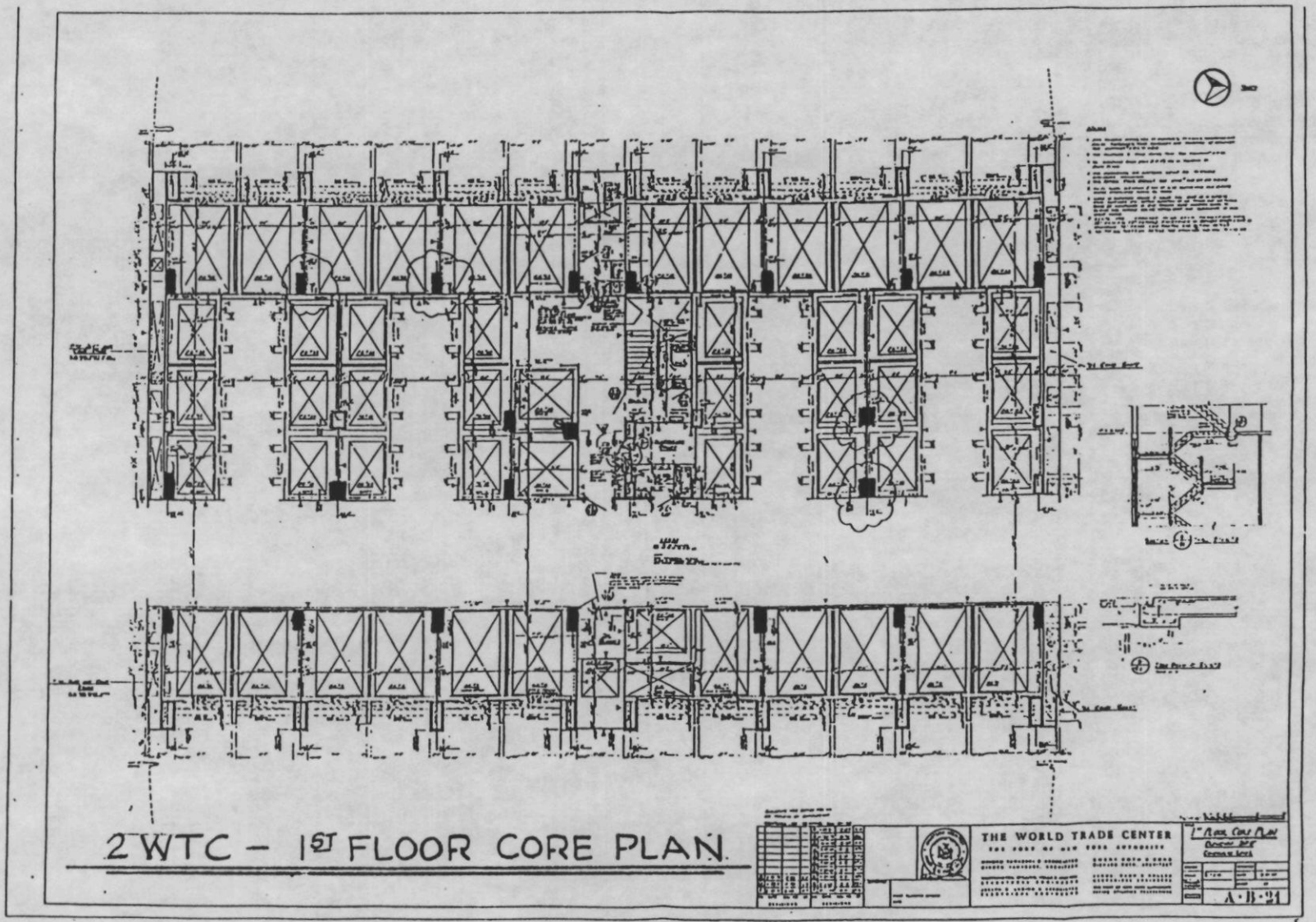
NORTH

LERA

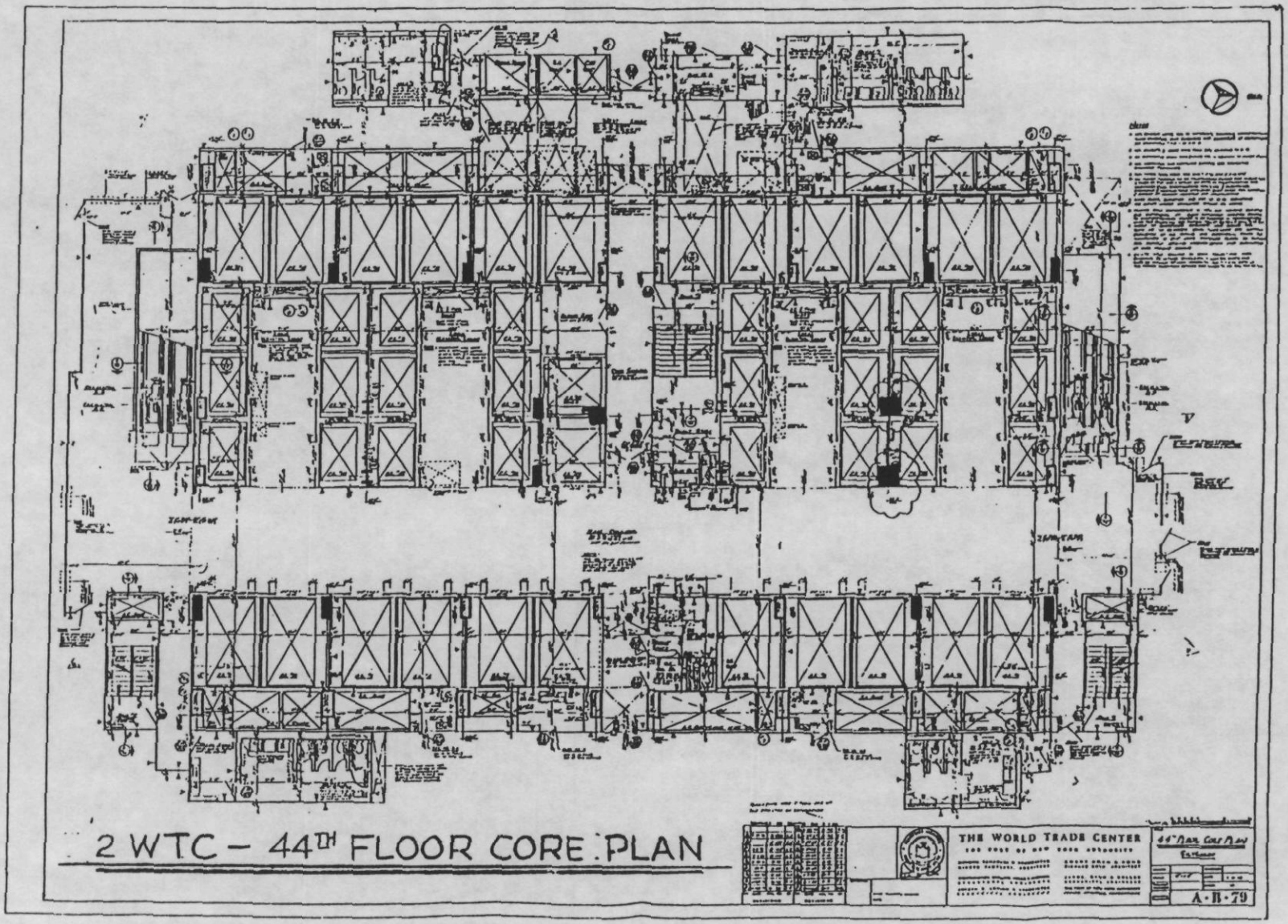


2 WTC – PLOT PLAN SHUTTLE AND FREIGHT ELEVATORS

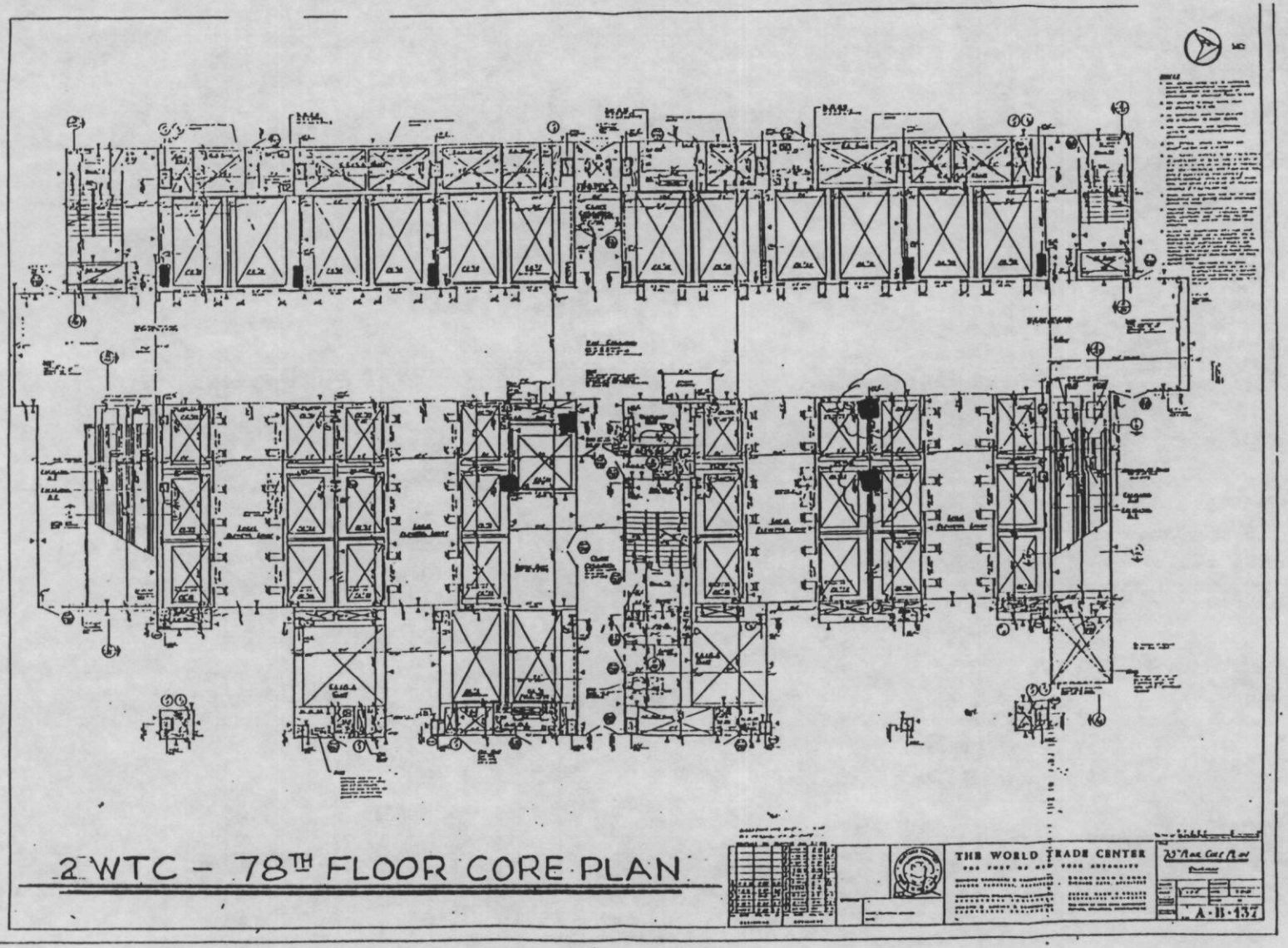
LERA



LERA



LERA



LERA

APPENDIX F

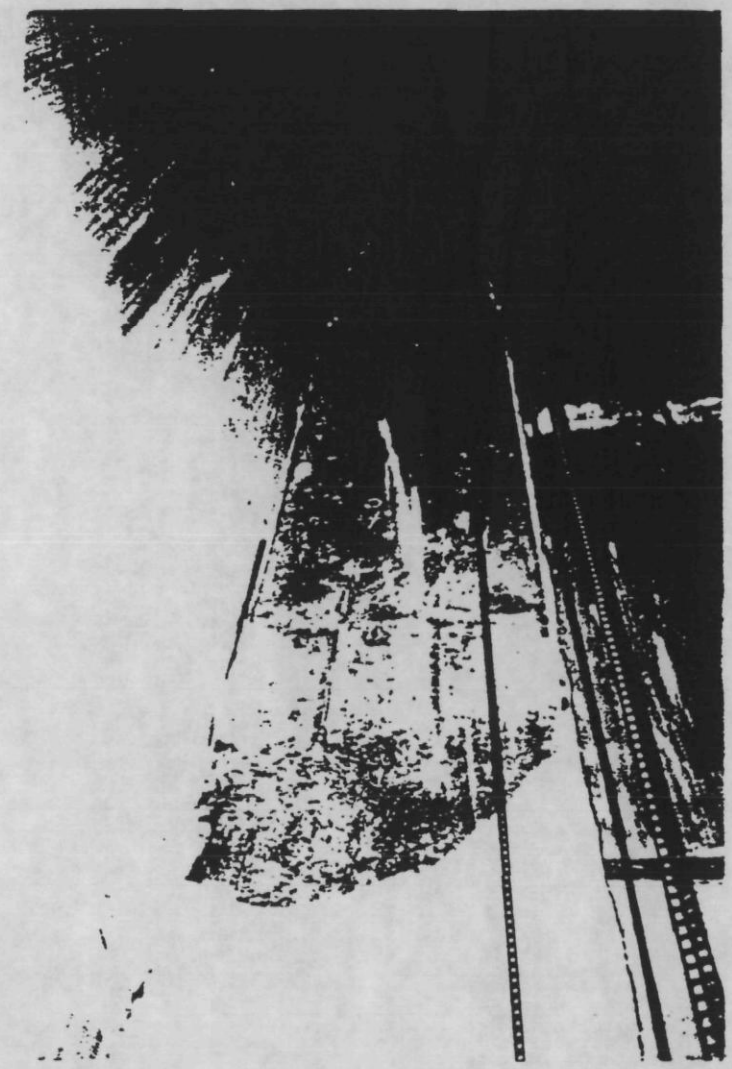
F.2 SCHEMATIC SECTION SHUTTLE & FREIGHT ELEVATORS AT 2 WTC

LERA

APPENDIX F

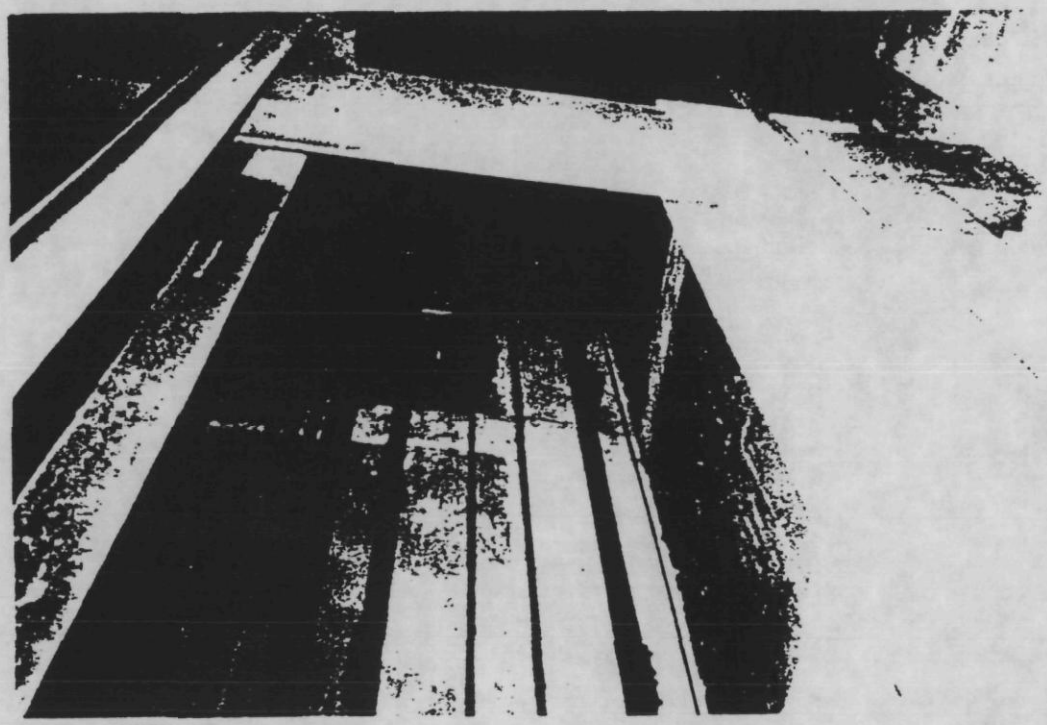
F.3 PHOTOGRAPHS OF TOWER TWO

LERA



36	2WTC - COL. #908 ELEV. SHAFT #1B 33-36TH FLOOR SIMILAR CONDITION AT 27-31ST FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2

LERA

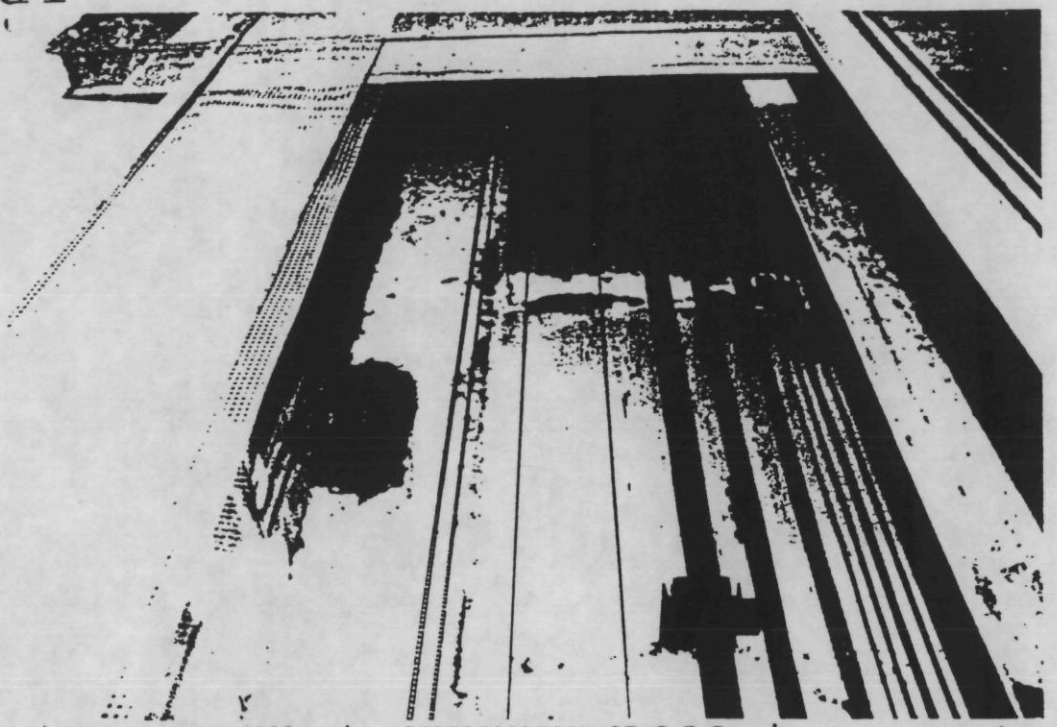


37	2WTC - COL. #907 ELEV. SHAFT #2B 21ST FLOOR - LOOKING UP	• TYPICAL CONDITION OF FIREPROOFING ENVELOPE	FP2	1

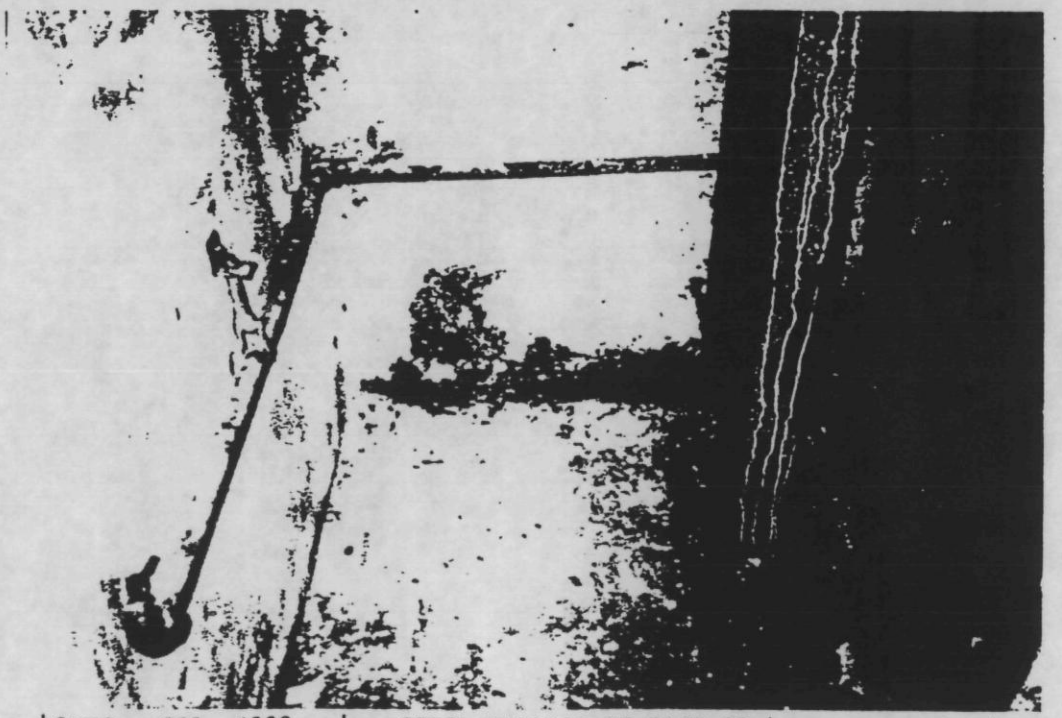
LERA

38	2WTC - COL. #902 ELEV. SHAFT #10B 34-36TH FLOOR SIMILAR CONDITION AT 7TH,20,22,25,39, & 40TH FLOOR	• LARGE AREA OF SPALLING FIREPROOFING • DETERIORATION OF S.F.P. AT CONNECTING BEAMS	FP1	2

LERA

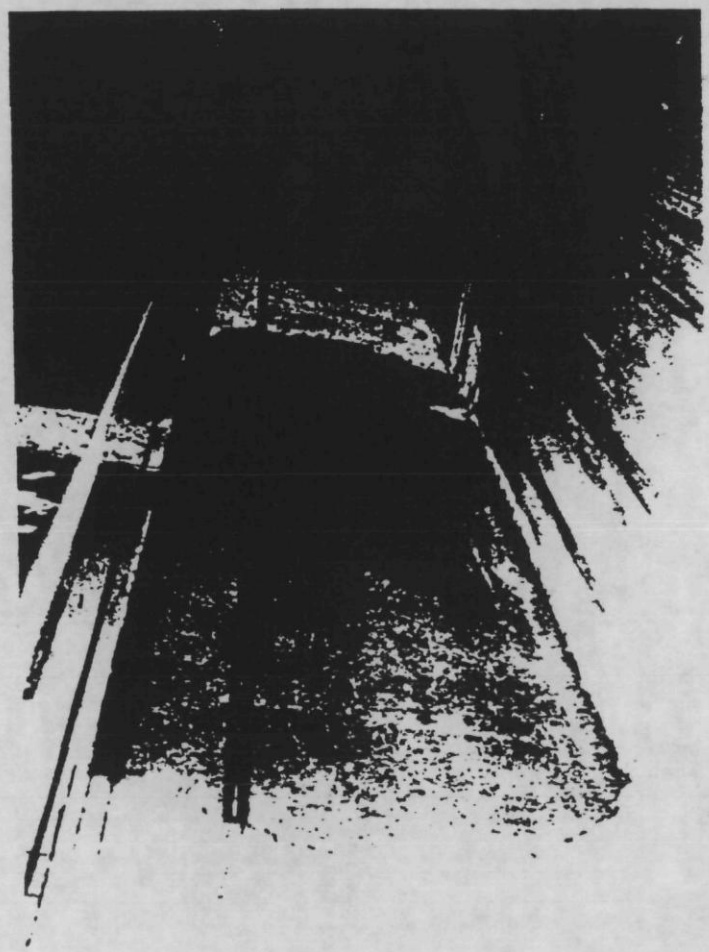


39	2WTC - COL. #902 ELEV. SHAFT #10B 20TH FLOOR TYPICAL AT ALL FLOORS	• DETERIORATION OF S.F.P. ALONG EDGE OF COLUMN AND CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS	FP1	2,3



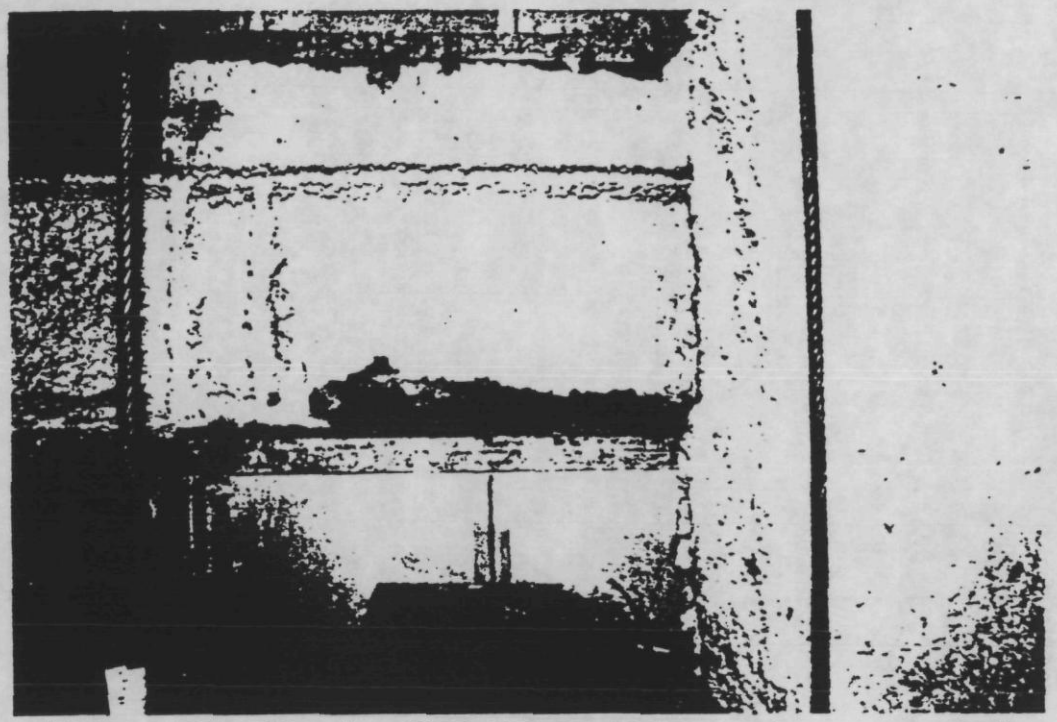
40	2WTC - COL. #902 ELEV. PIT #10B SIMILAR CONDITION AT ELEV. PIT #11B	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP1	5

LERA



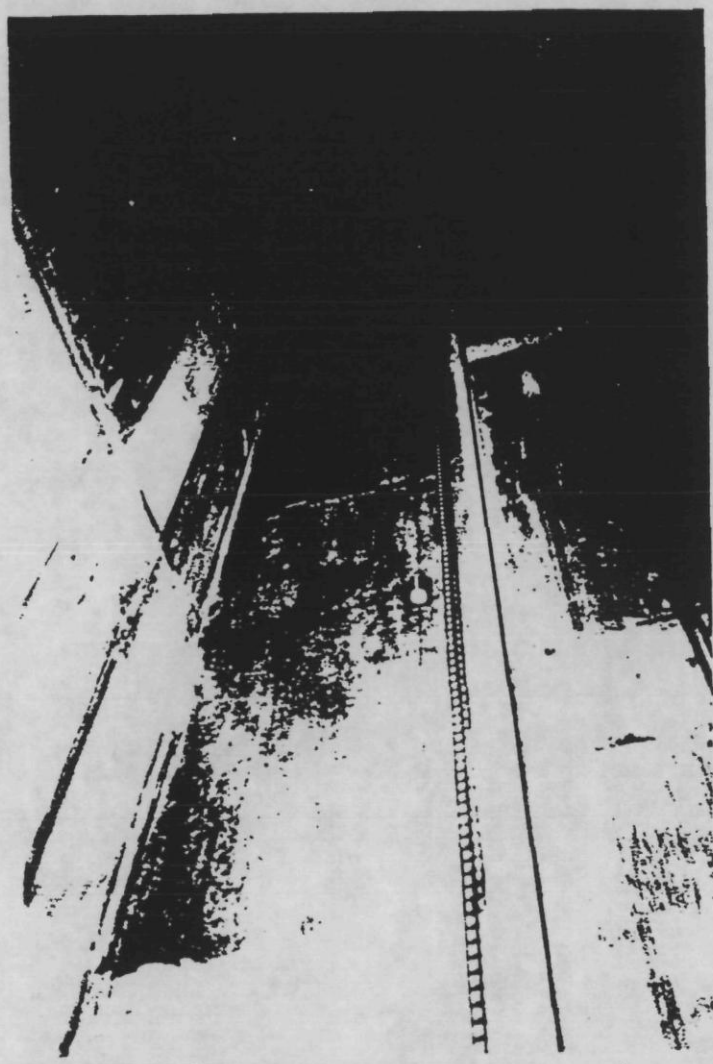
41	2WTC - COL. #901 ELEV. SHAFT #11B 31ST FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP1	2,3

LERA



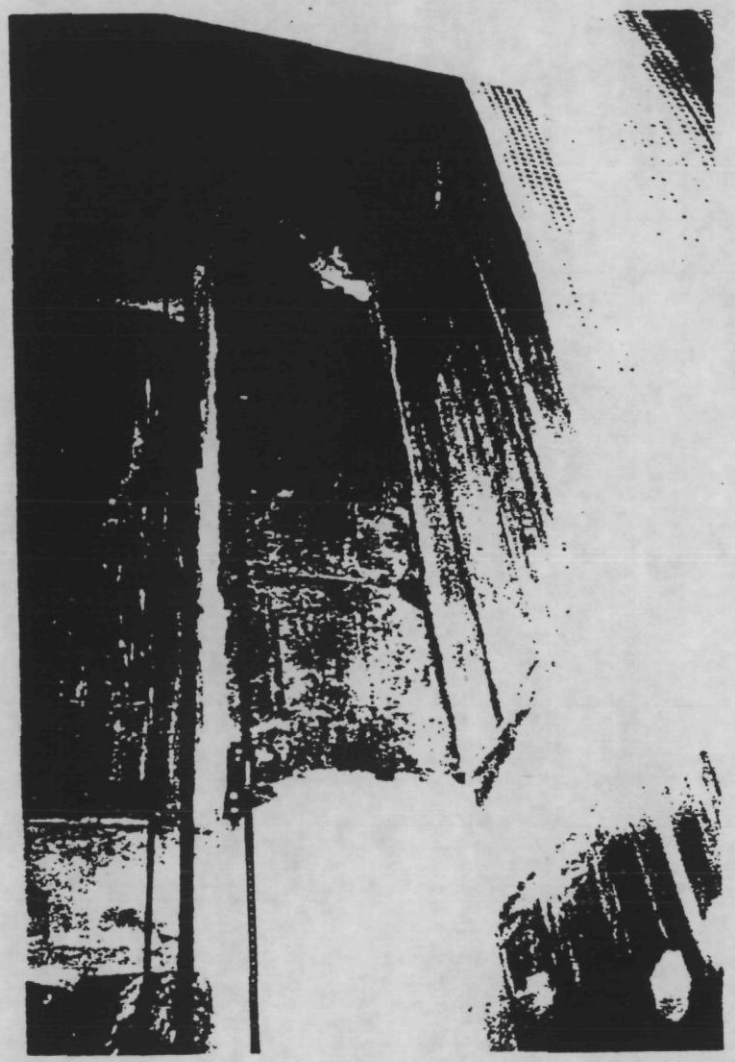
42	2WTC - COL. #901 ELEV. SHAFT #11B 15TH FLOOR TYPICAL CONDITION AT ALL FLOORS	• STEEL EXPOSED AT THE BOTTOM FLANGE OF CONNECTING BEAM • MODERATE SURFACE RUST	FP1	3

LERA



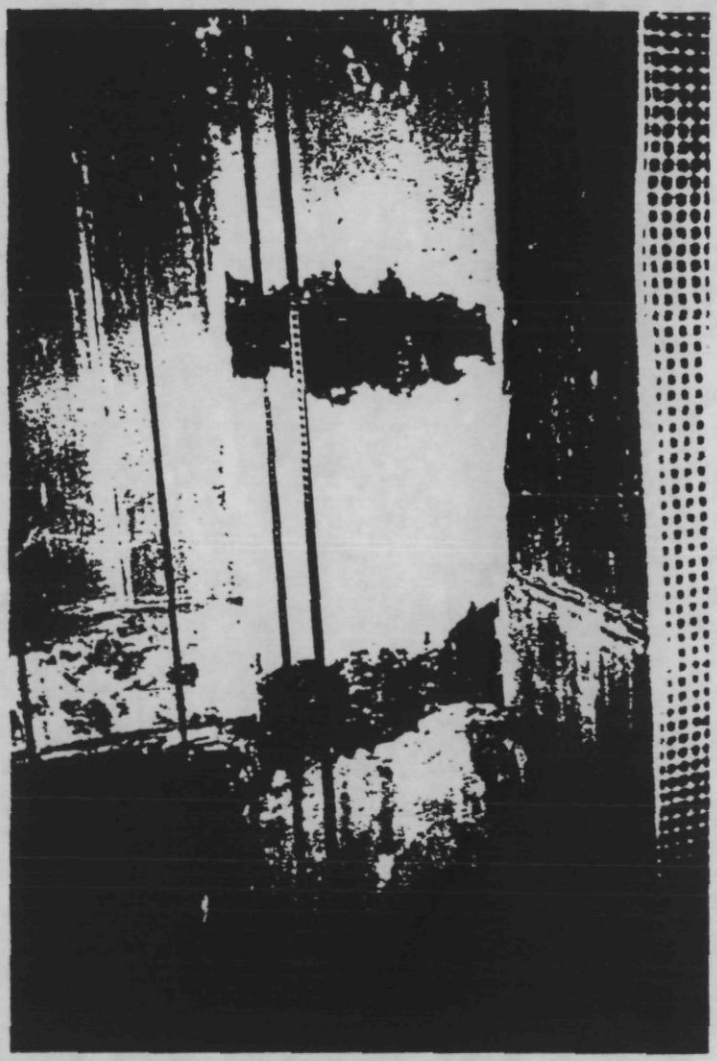
43	2WTC - COL. #601 ELEV. SHAFT #12B 35-37TH FLOOR SIMILAR CONDITION AT 25TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2

LERA



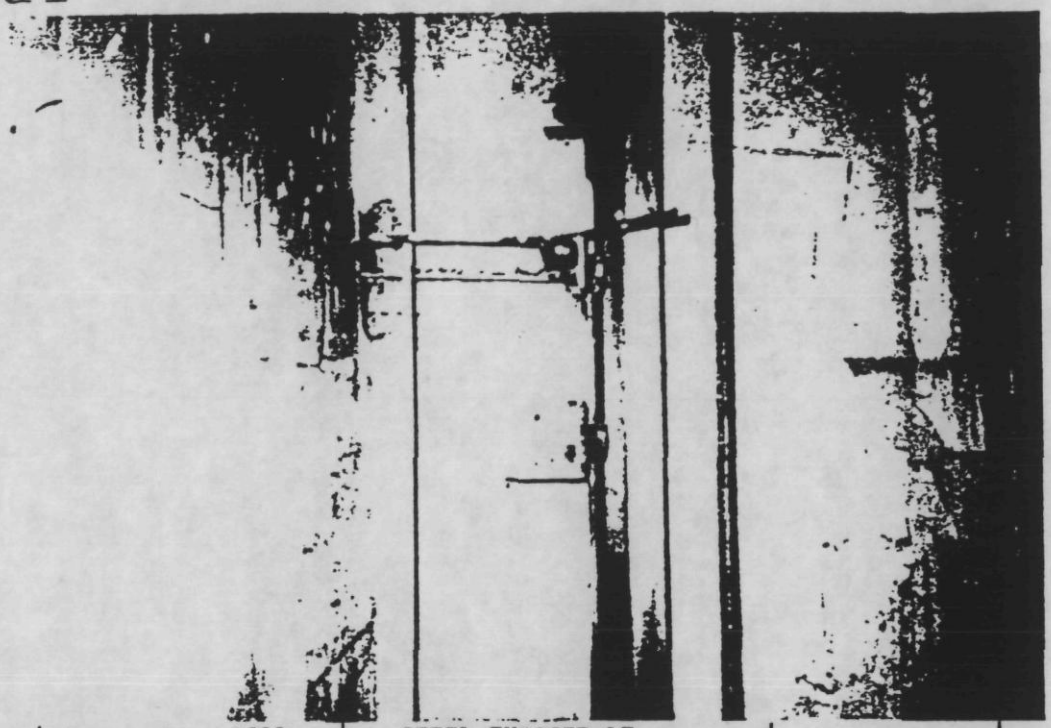
44	2WTC - COL. #602 ELEV. SHAFT #13B 35-37TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2

LERA

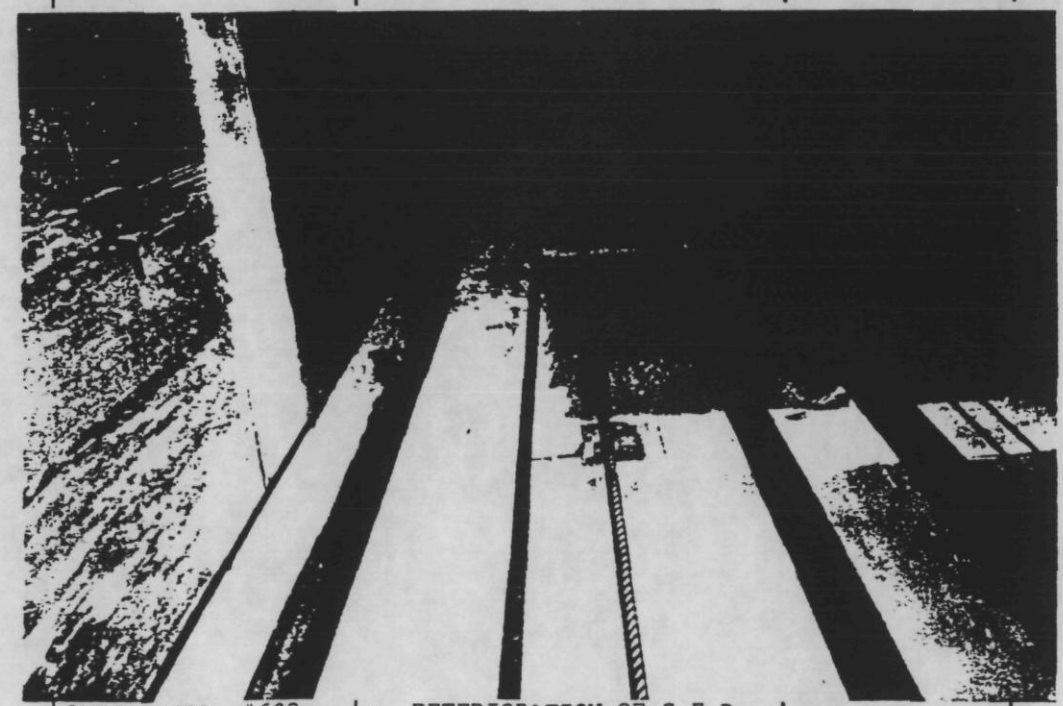


45	2WTC - COL. #602 ELEV. SHAFT #13B 12TH FLOOR SIMILAR CONDITON AT 7TH,10,14,27,48,63, 66 & 75TH FLOOR__	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	3

LERA

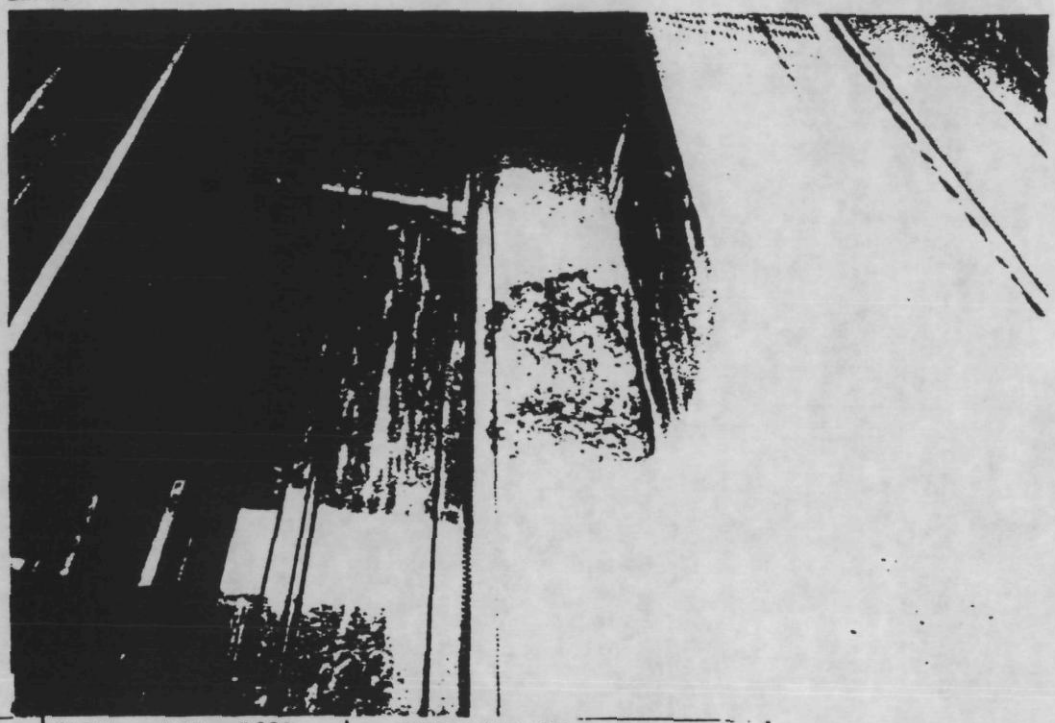


46	2WTC - COL. #602 ELEV. SHAFT #14B 42ND FLOOR TYPICAL CONDITION	• STEEL EXPOSED AT ANTIWIND BRACKET GUIDE AT CORNER • LIGHT SURFACE RUST	FP2	3



47	2WTC - COL. #602 ELEV. SHAFT #14B 15TH FLOOR - LOOKING UP	• DETERIORATION OF S.F.P. AT CONNECTING BEAMS • STEEL EXPOSED AT CONNECTING BEAMS WITHIN 3 FOOT FROM COLUMN • LIGHT SURFACE RUST	FP2	3

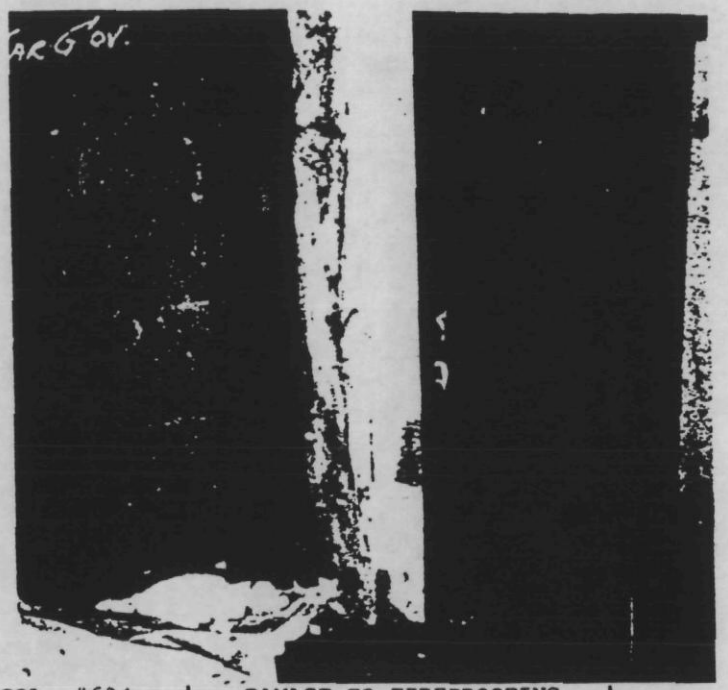
LERA



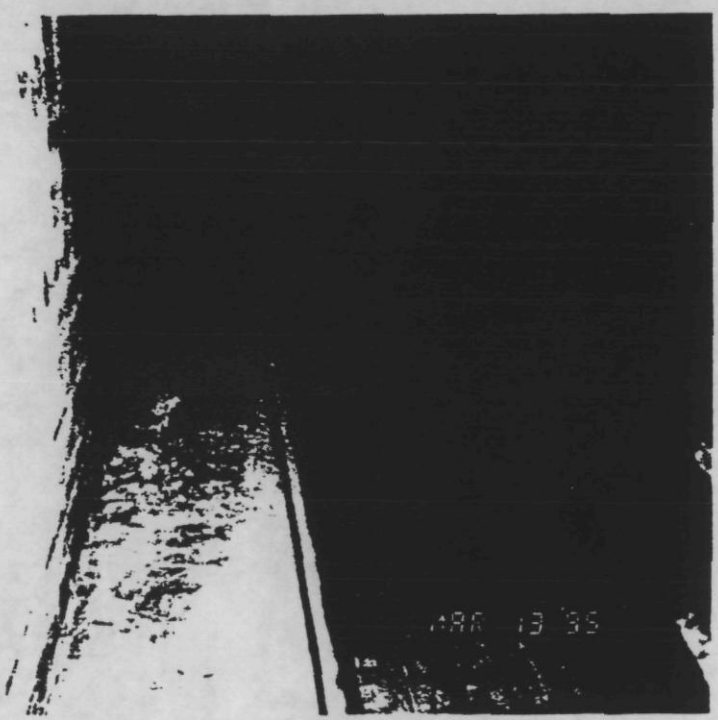
48	2WTC - COL. #603 ELEV. SHAFT #15B 25TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2

49	2WTC - COL. #603 ELEV. SHAFT #15B 3RD FLOOR - LOOKING UP	• WATER LEAKS TO FIREPROOFING ENVELOPE • DETERIORATION OF S.F.P.	FP2	3,4

LERA

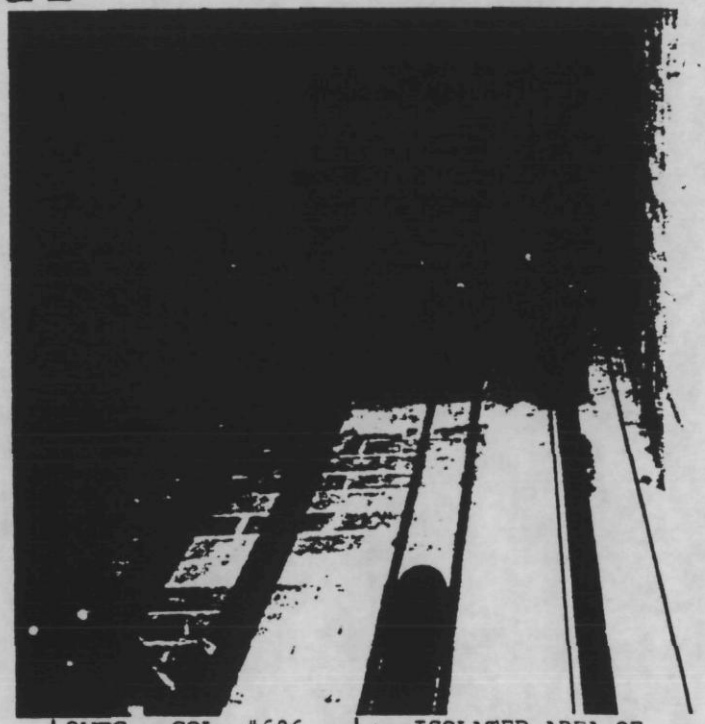


50	2WTC - COL. #604 ELEV. PIT #17B	• DAMAGE TO FIREPROOFING ENVELOP AT BASE OF COLUMN • STEEL EXPOSED • LIGHT TO MODERATE SURFACE RUST	FP2	5

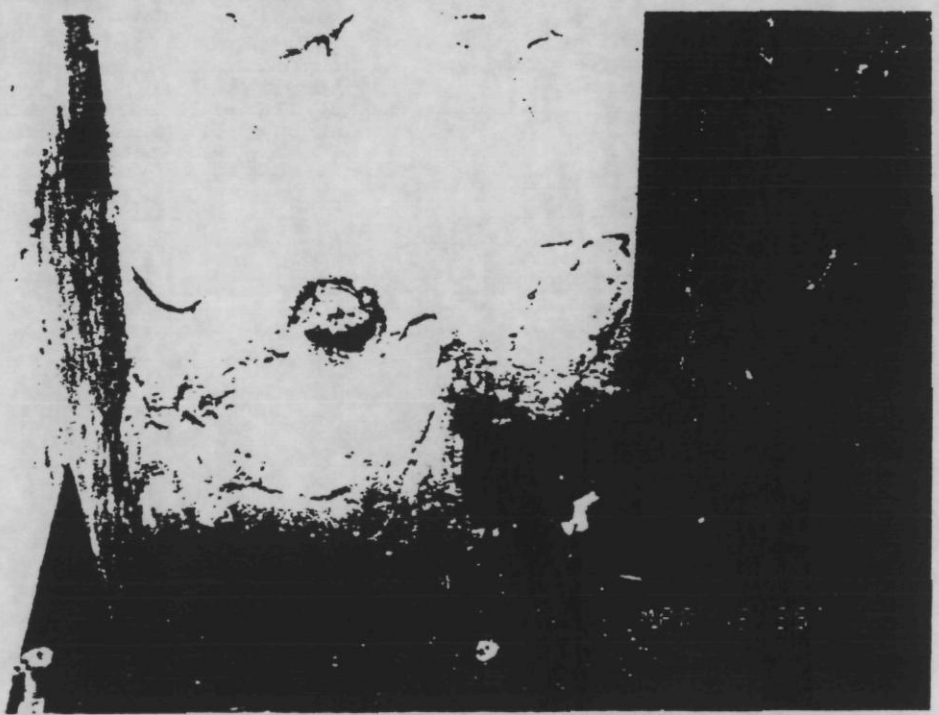


51	2WTC - COL. #605 ELEV. PIT #18B LEVEL B2 - LOOKING UP	• WATER LEAKS TO FIREPROOFING ENVELOPE • DETERIORATION OF S.F.R.	FP2	3,4

LERA

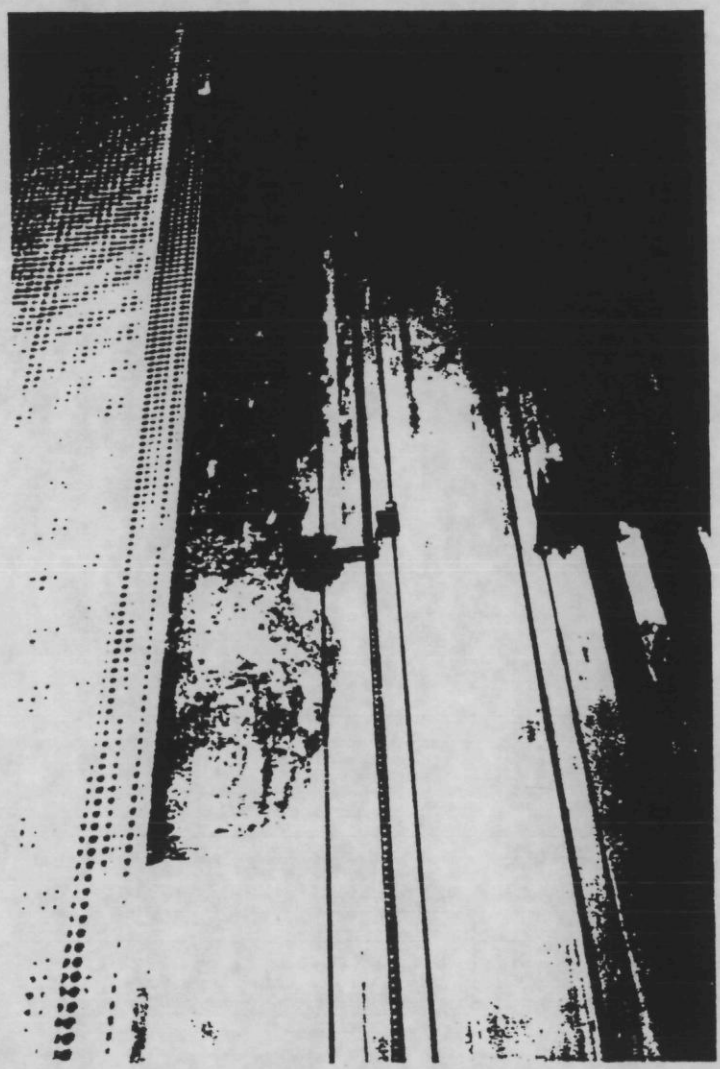


52	2WTC - COL. #606 ELEV. PIT #19B LEVEL B2 - LOOKING UP	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2



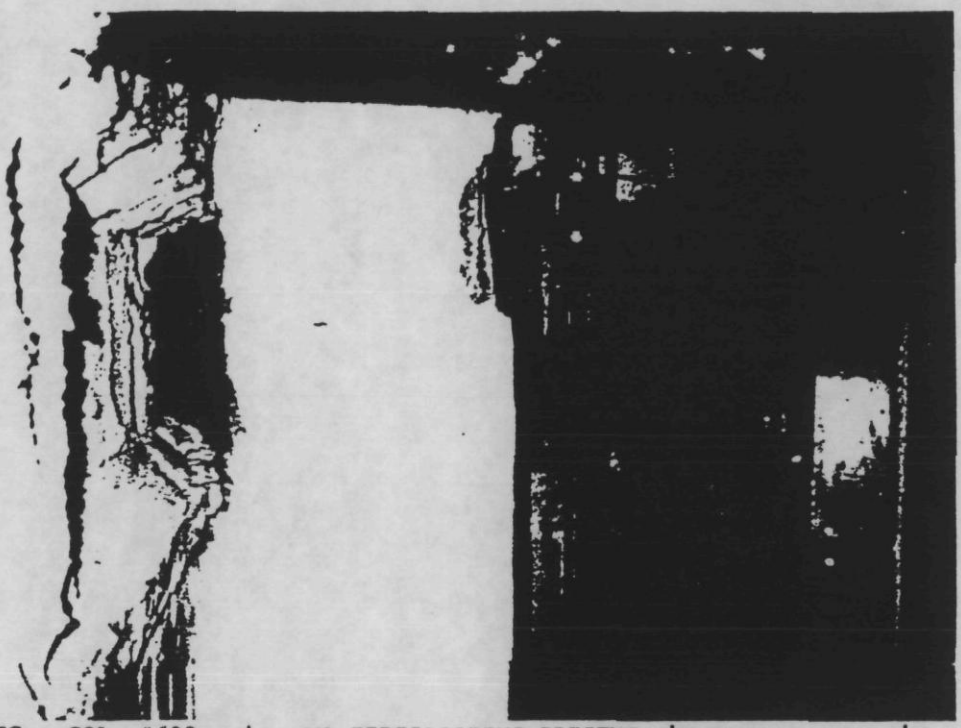
53	2WTC - COL. #606 ELEV. PIT #20B LEVEL B2 - LOOKING UP	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	FP2	3

LERA

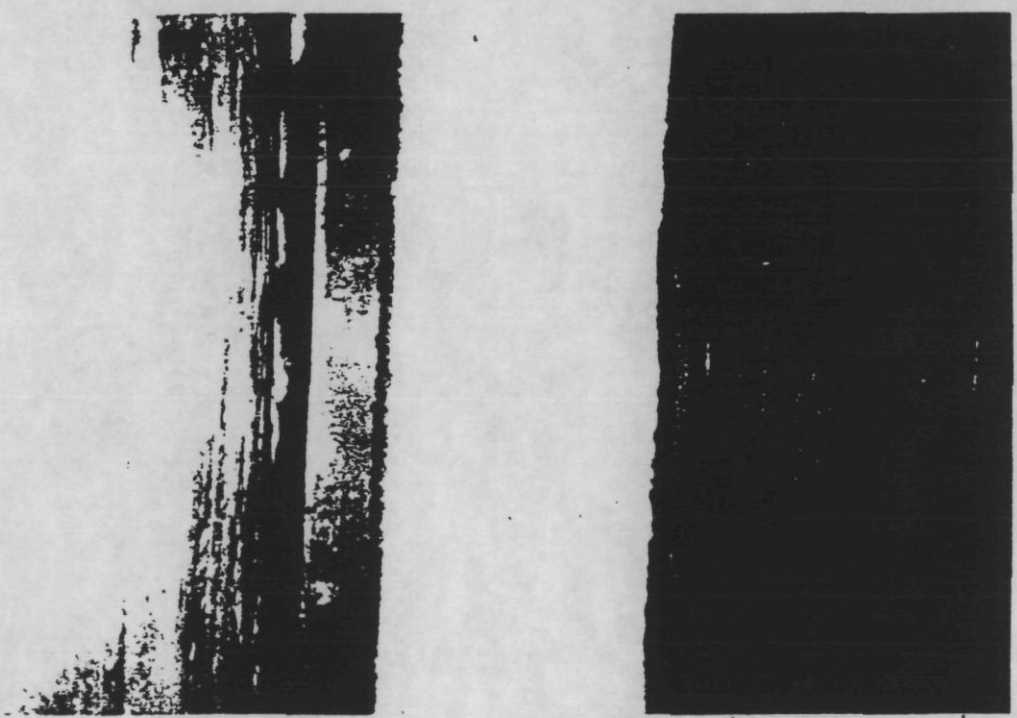


54	2WTC - COL. #607 ELEV. SHAFT #22B 29-30TH FLOOR SIMILAR CONDITION AT 47,57,59,64 & 74TH FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING • LIGHT SURFACE RUST	FP2	2

LERA



55	2WTC - COL. #608 ELEV. SHAFT #23B 70TH FLOOR TYPICAL CONDITION	• NO FIREPROOFING PRESENT AT THE NORTH FACE OF COLUMN AT CONNECTING BEAM	FP2	3

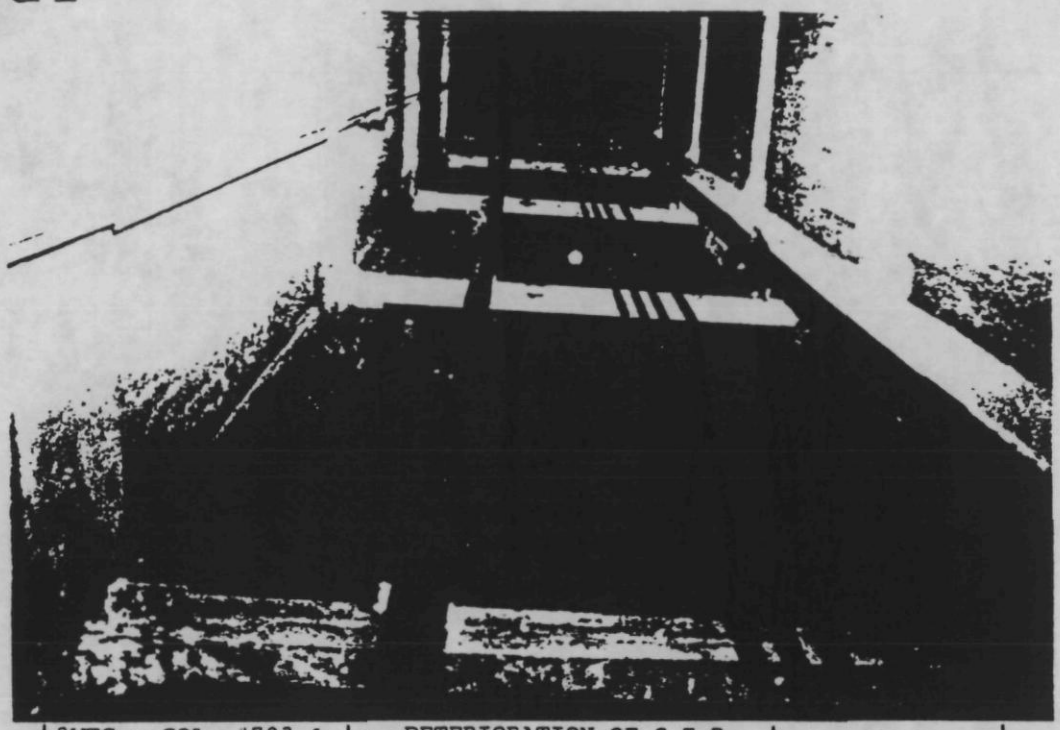


56	2WTC - COL. #608 ELEV. SHAFT #23B 45TH FLOOR	• NO FIREPROOFING PRESENT AT THE NORTH FACE OF COLUMN WITHIN 6'-0" BELOW THE FLOOR LEVEL	FP2	2,3

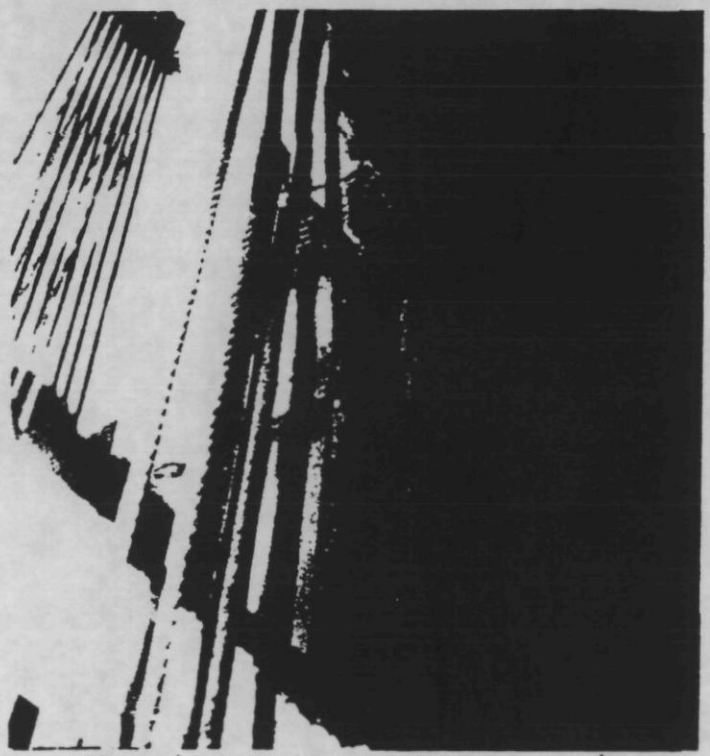
LERA

57	2WTC - COL. #608 ELEV. SHAFT #23B 41ST FLOOR	• ISOLATED AREA OF SPALLING FIREPROOFING	FP2	2

LERA

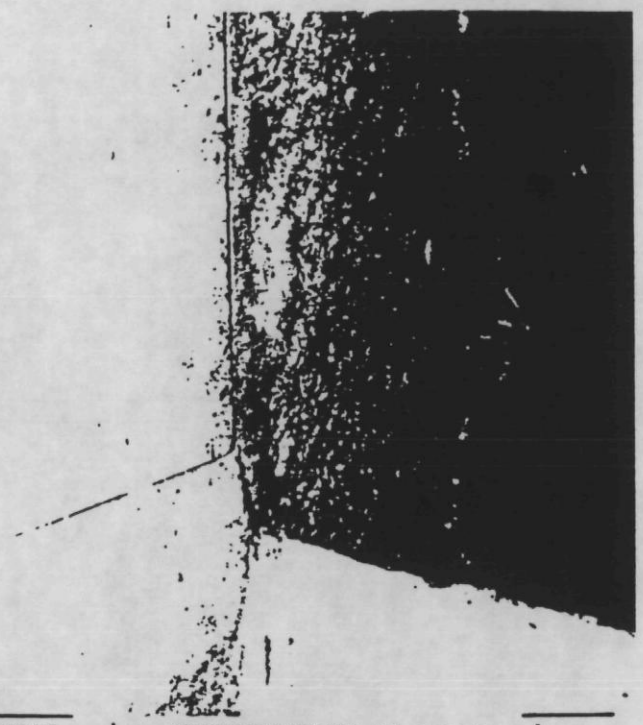


58	2WTC - COL. #703 & 704 ELEV. SHAFT #50B 48TH FLOOR TYPICAL CONDITION	• DETERIORATION OF S.F.P. • STEEL EXPOSED AT CONNECTING BEAMS		FP1 FP2	2,3

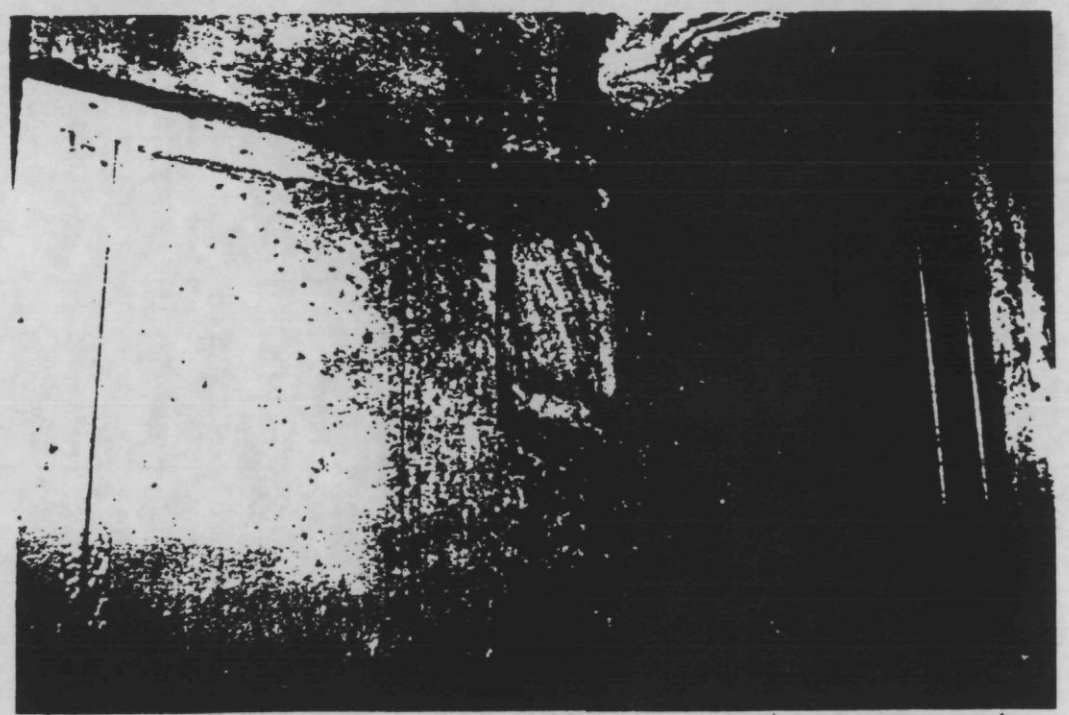


59	2WTC - COL. #704 ELEV. SHAFT #50B 74TH FLOOR TYPICAL CONDITION	• DETERIORATION OF S.F.P. • STEEL EXPOSED AT CONNECTING BEAMS		FP1 FP2	2,3

LERA



60	2WTC - COL. #703 ELEV. SHAFT #50B 5TH FLOOR TYPICAL CONDITION	• DETERIORATION OF S.F.P. • STEEL EXPOSED	FP1	2,3

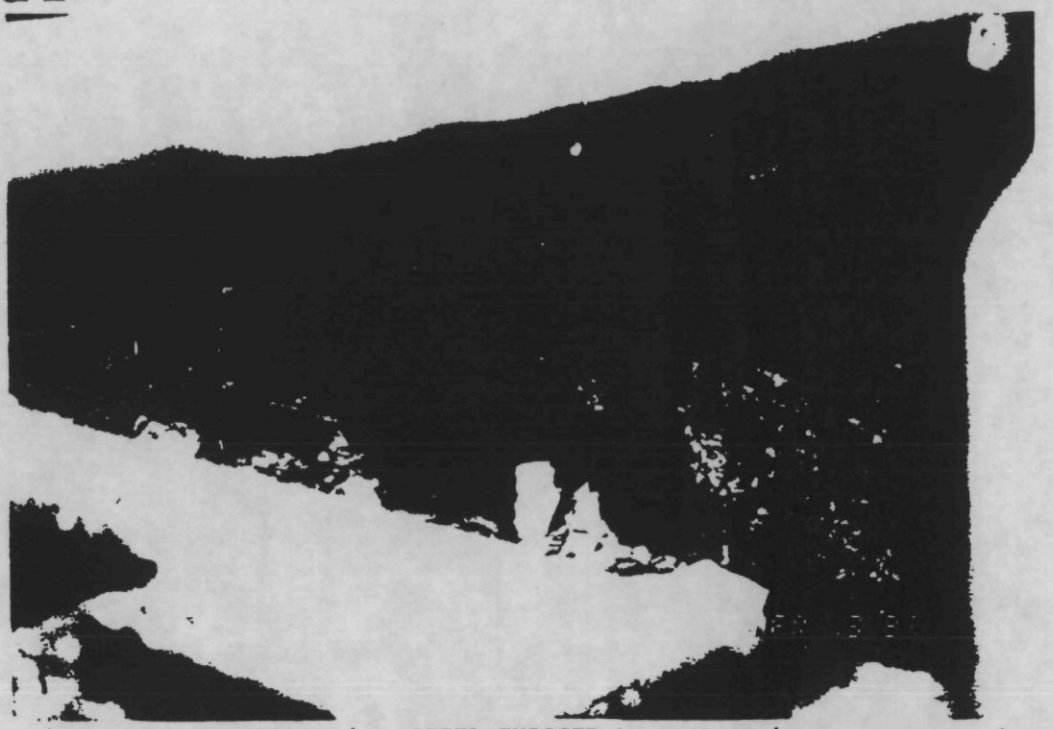


61	2WTC - COL. #703 ELEV. SHAFT #50B 17TH FLOOR	• THE STIFFNER PLATE AT CONNECTING BEAM TO COLUMN WAS TWISTED • STEEL EXPOSED	FP1	7

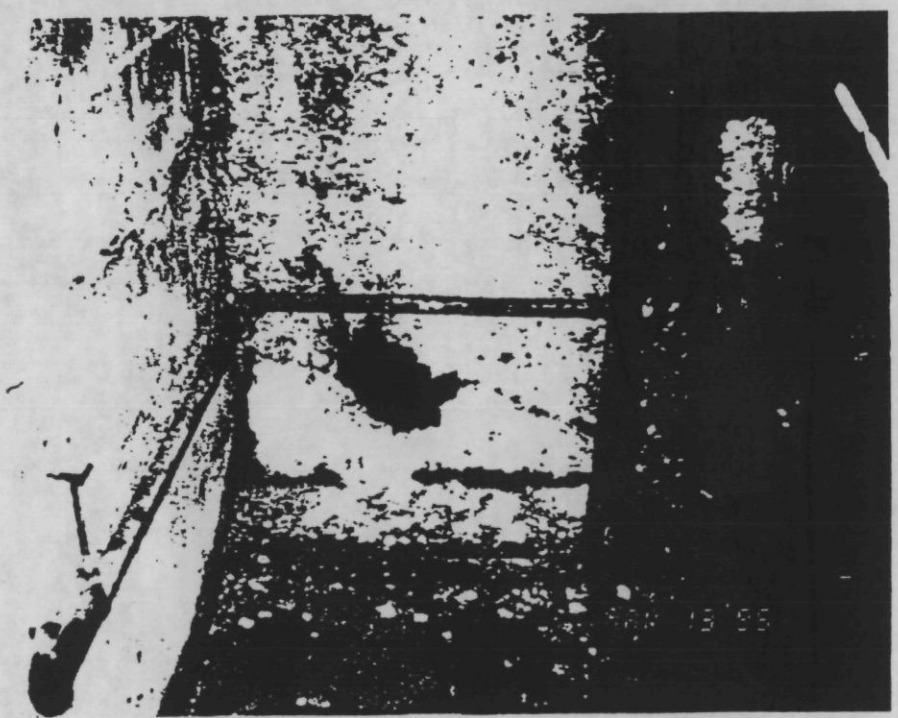
LERA

62	2WTC - COL. #704 ELEV. PIT #49B LEVEL B6	• COLUMN EXPOSED • LIGHT TO MODERATE SURFACE RUST OBSERVED • DEBRIS ACCUMMULATION	-	5

LERA

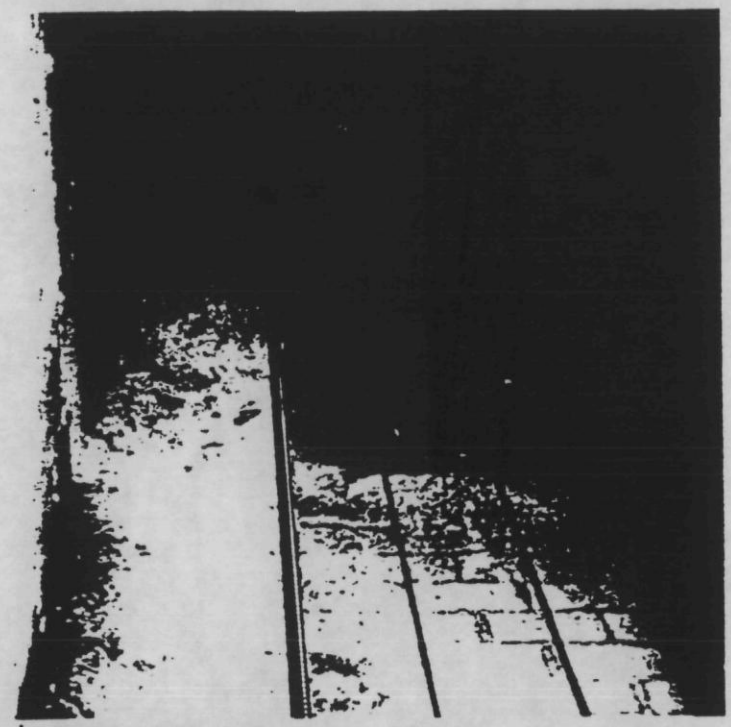


63	2WTC - COL. #703 ELEV. PIT #49B LEVEL B6	• STEEL EXPOSED AT BASE OF COLUMN • MODERATE SURFACE RUST • NO FIREPROOFING PRESENT	-	5

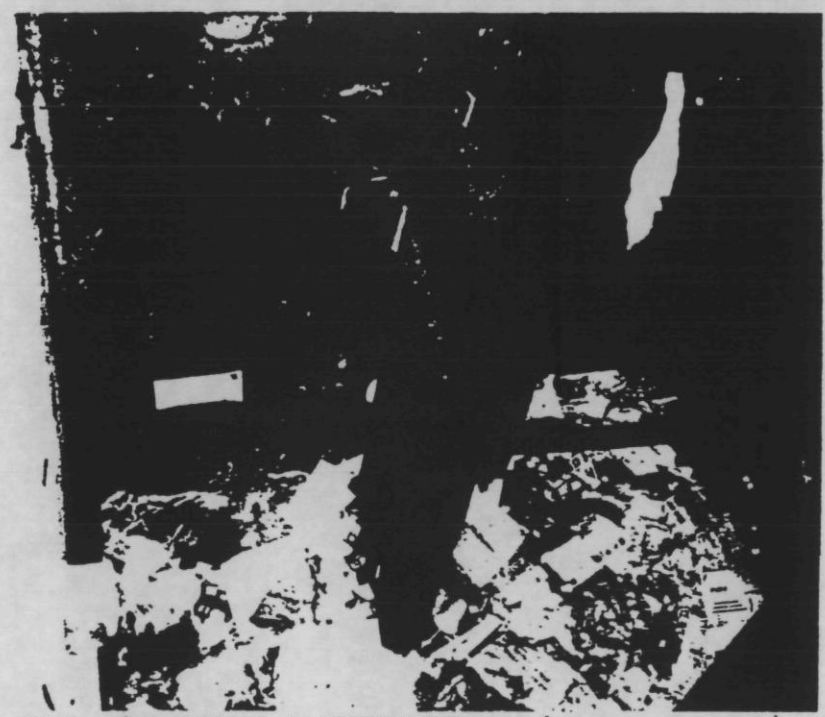


64	2WTC - COL. #903 ELEV. PIT #8B LEVEL B2	• STEEL EXPOSED AT BASE OF COLUMN • LIGHT TO MODERATE SURFACE RUST OBSERVED	FP1	5

LERA

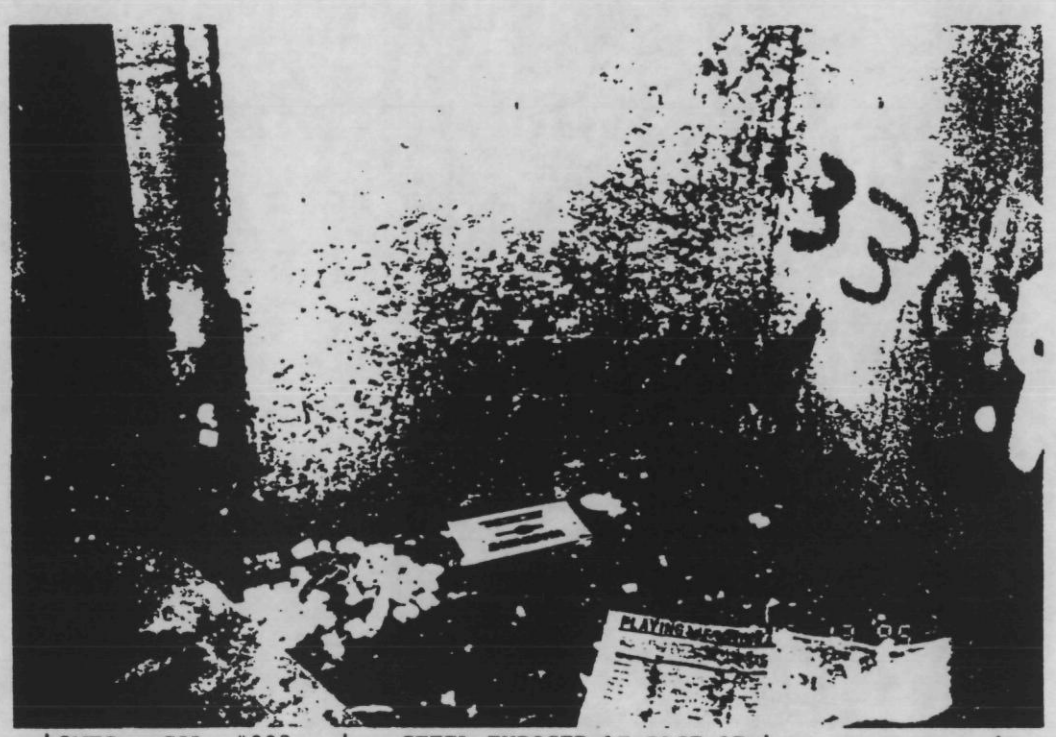


65	2WTC - COL. #903 ELEV. SHAFT #8B LEVEL B2, LOOKING UP	• DETERIORATION OF S.F.P.	FP1	3



66	2WTC - COL. #906 ELEV. SHAFT #5B	• DEBRIS ACCUMMILATION INSIDE THE ELEV. PIT	FP2	3

LERA



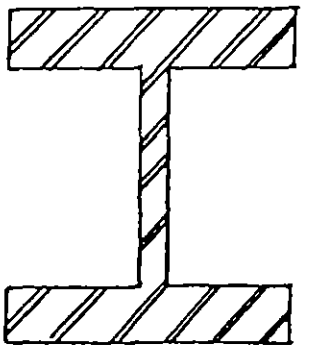
67	2WTC - COL. #803 ELEV. SHAFT #47B	• STEEL EXPOSED AT BASE OF COLUMN • LIGHT TO MODERATE SURFACE RUST OBSERVED	FP1	5

LERA

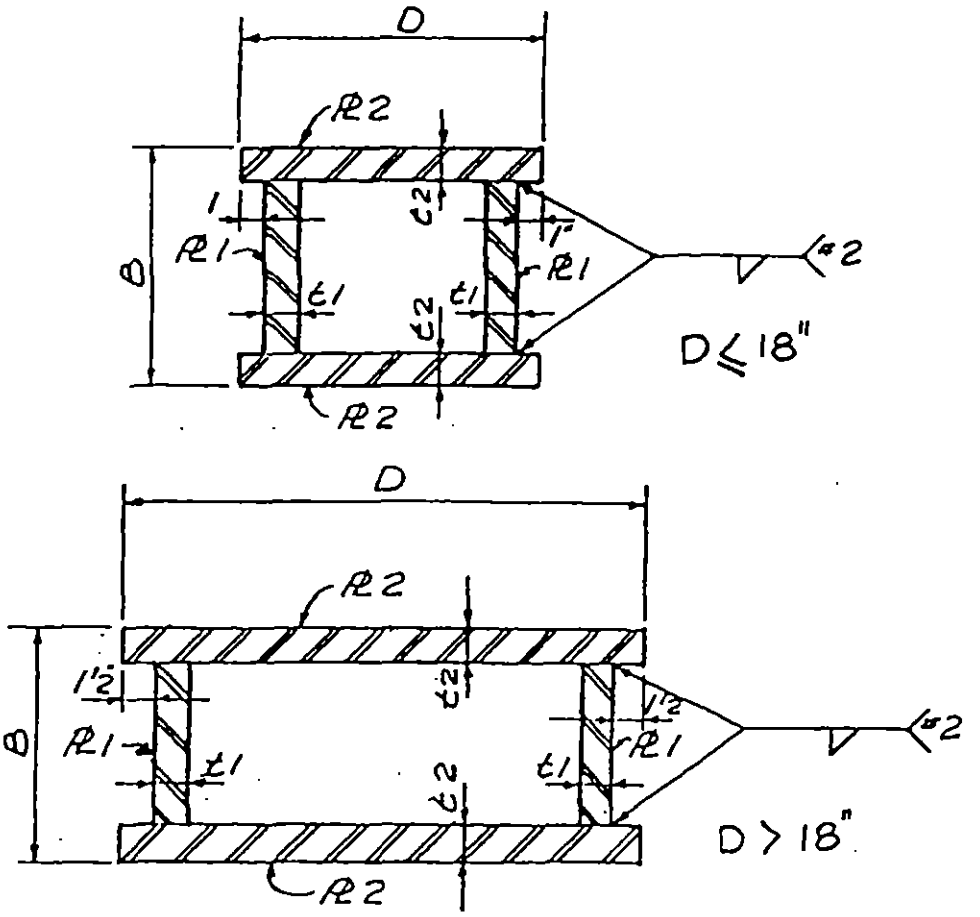
APPENDIX G

G.1 TYPICAL STRUCTURAL DETAILS

LERA



TYPICAL WIDE FLANGE COLUMN



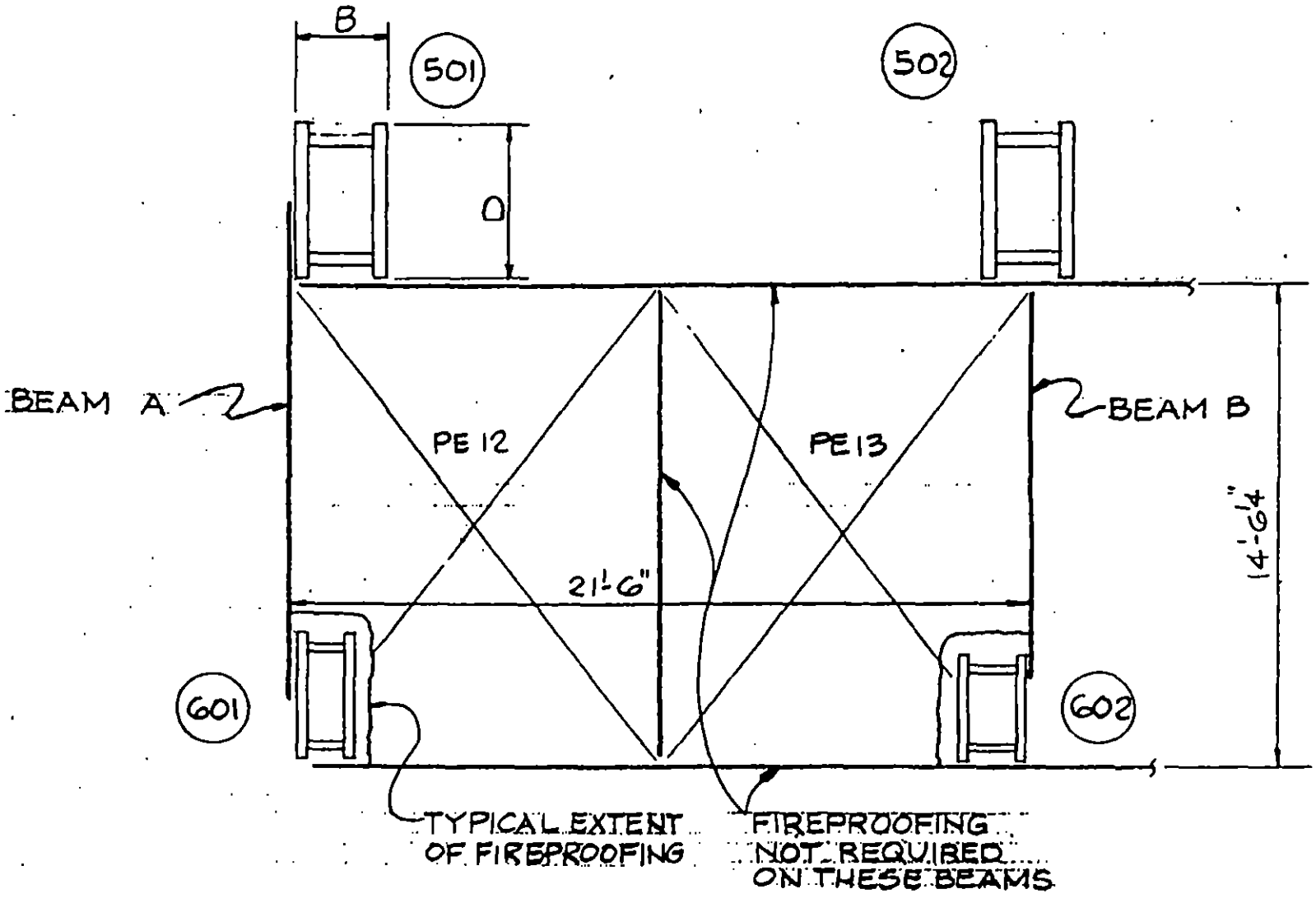
TYPICAL BOX COLUMN

LERA

APPENDIX G

G.2 FIREPROOFING SYSTEM DETAILS

LERA



PART PLAN
TYPICAL FLOOR

LERA

APPENDIX H

GENERAL NOTES AND SPECFICATIONS FOR SPRAY-ON FIREPROOFING

DIVISION 7 - FIREPROOFING

SECTION 7A

SPRAY-ON REPLACEMENT FIREPROOFING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Scope: Contractor shall examine all of the Contract Documents for the extent of the Work of this Section of the Specifications. That Work shall include all labor, materials, devices, plants, tools, equipment, appliances and services necessary for, and incidental to, the complete and proper installation of all spray-applied replacement fireproofing and related work as specified herein, as required by job conditions, and as required by governing authorities which would have jurisdiction, if the Authority were a private corporation. Work shall include, but shall not be limited to, the following:

1. Spray-on replacement fireproofing for column and beam surfaces exposed within the elevator shafts of 1 WTC and as directed.

2. Cleaning and preparing surfaces to receive spray-on replacement fireproofing as required.

3. Clean-up, removal and proper disposal of overspray and packaging materials.

1.02 RELATED WORK OF OTHER SECTIONS

A. Related Work:

1. Testing and Inspection of Spray-On Fireproofing: Section 7B.

1.03 REFERENCES

A. ASTM Standards:

1. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. E119 - Standard Methods of Fire Tests of Building Construction and Materials.

3. E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

4. E605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.

5. E736 - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

6. E761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

7. E859 - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

8. E937 - Standard Test Method for Corrosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

B. Underwriters' Laboratories, Inc. (ULI) Fire Resistance Directory.

1.04 SUBMITTALS

A. **Manufacturer's Data:** Submit the following:

1. Manufacturer's instructions for proper application of sprayed-on fireproofing; and

2. Certification that the material conforms in all regards with the Contract Documents.

B. **Test Data:** Independent laboratory test results shall be submitted for the following performance criteria for the fireproofing material(s) used:

1. Bond Strength per ASTM E736.

2. Compressive Strength per ASTM E761.

3. Air Erosion per ASTM E859.

4. Corrosion Resistance per ASTM E937.

C. **Overspray Protection:** Contractor shall submit for approval by the Authority means and methods to prevent overspray on elevator equipment and other surfaces.

D. **Deviations:** Should Contractor desire a Deviation from the Specifications, Contractor shall call the specific Deviation to Engineer's attention in writing. Requests for Deviations shall be submitted on Contractor's letterhead.

E. **Field Work Drawings:** Submit for Engineer's review Field Work Drawings depicting all field work required to accommodate field conditions.

1.05 QUALITY ASSURANCE

A. **Fireproofing Work** shall be performed by a Contractor acceptable to the spray applied fireproofing materials manufacturer. The employees doing the work shall be experienced with the installation of the materials specified.

B. **Codes, Standards, Specifications and Other Reference Documents** cited in this Specification are declared to be a part of this Specification, the same as if fully set forth herein.

C. **Codes:** All Work under this Section shall conform to the regulations of all governmental authorities which would have jurisdiction if the Authority were a private corporation.

1.06 PERFORMANCE CRITERIA - REPLACEMENT FIREPROOFING

A. **Fire Rating:** Products, execution and fireproofing thickness are intended to provide for a minimum fire resistance rating of 2 hours for beams (restrained), 3 hours for columns. Thickness shall be as specified in the Contract Drawings.

B. **Dry Density:** Minimum average field dry density and minimum individual density shall be as specified below, unless otherwise requested by the authority having jurisdiction. Determine density in accordance with ASTM E605.

	MINIMUM AVERAGE DENSITY	MINIMUM INDIVIDUAL DENSITY
Monokote Type 106	22 pcf	19 pcf
CAFCO 560	34 pcf	31 pcf
ALBI Duraspray	27 pcf	25 pcf

C. **Bond Strength:** Fireproofing when tested in accordance with ASTM E736 shall have a minimum average bond strength of 600 psf or the manufacturers advertised value, whichever is greater.

D. **Air Erosion:** When tested in accordance with ASTM E859 the maximum allowable weight loss of the fireproofing material shall be 0.025 grams/ft^2 or the manufacturers advertised value, whichever is less.

E. **Compressive Strength:** When tested in accordance with ASTM E761, the compressive strength of the material shall be 69.4 psi or the manufacturers advertised value, whichever is greater.

F. **Corrosion Resistance:** Material shall show no evidence of corrosion of unpainted steel when tested in accordance with ASTM E937.

1.07 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to the project site in original unopened packages, fully identified as to manufacturer, brand and other identifying data, and bearing the proper Underwriters' Laboratories, Inc. labels for fire resistance classification.

B. Material shall be stored in a dry location until ready for use. Damaged packages and packages that have been exposed to water before use shall be found unsuitable for use and shall be promptly removed from the project site.

1.08 TESTING AND INSPECTION

A. All Work and all construction processes of manufacture and methods of construction involved in or related to the performance of the Work shall be at all times and places subject to the inspection of the Engineer. Refer to Section 7B - "Testing and Inspection of Spray-On Fireproofing".

1.09 JOB CONDITIONS

A. Contractor's Responsibility: Contractor shall be solely responsible for the correctness of quantities; for Work to be confirmed and correlated at the site; for information pertaining to the means, methods, techniques, sequences and procedures of construction; and for the coordination and scheduling of the Work of this Section. Engineer's review of Contractor's submissions does not relieve Contractor from these responsibilities.

B. Cooperation: Prior to starting applicable phases of the Work of this Section (i.e., cleaning of surfaces to receive spray applied replacement fireproofing, applying spray applied replacement fireproofing, etc.), Contractor shall cooperate and coordinate with Owner, the Work of this Section. Contractor shall report unsatisfactory or nonconforming conditions to Engineer in writing prior to the start of Work.

C. Contractor shall provide ventilation to allow for proper drying of the fireproofing during and subsequent to its application. Where natural ventilation is not adequate, forced air circulation shall be provided by the Contractor to achieve a total air exchange rate of not less than 4 times per hour until the fireproofing material is substantially dry.

D. Conduct fireproofing application operations in a manner which protects persons in the vicinity against exposure to spray applied materials.

E. Protect equipment and other surfaces not to receive fireproofing. Protect elevator hoist cables, compensating cables, governor cables and selector tapes from overspray. Remove excess fireproofing material and remove fireproofing material from surfaces not to receive fireproofing.

F. Contractor shall specify in his bid the amount of on-site storage space needed for equipment and materials, and also the water supply and electrical energy requirements for the installation.

G. Contractor may use tops of elevator cabs. A platform on top of the cabs will be provided. This platform has an allowable load of 85 pounds per square foot and a maximum point load of 1000 pounds. Elevator operators will be provided by the Authority.

H. Contractor may use floor 23 for preparation and staging of materials.

1.10 GUARANTEE

A. Applicator shall guarantee that the installation of material conforms to manufacturer's recommendations and to project specifications, and shall further guarantee the workmanship connected with the installation for a period of five years from date of installation. Applicator shall obtain from the Manufacturer a warranty, for a like period, that the material conforms to Manufacturer's specifications and to project specifications and is free from manufacturing defects. At any time during the guarantee period, Applicator shall replace or repair to the satisfaction of Owner any portion of the installation which does not meet the requirements of project specifications, at no cost to Owner.

B. Contractor shall specify in his bid the terms and conditions of the guarantee.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Spray-On Fireproofing: The sprayed replacement fireproofing materials shall have been tested and reported by Underwriters' Laboratories, Inc. in accordance with the procedures of ASTM E119. Acceptable products are:

1. Type 106 as manufactured by the Construction Products Division of W.R. Grace and Co.

2. Other material accepted by Engineer.

B. Mixing water shall be clean, fresh, potable and free from such amounts of mineral organic substances as would affect the set of the fireproofing material.

PART 3 - EXECUTION

3.01 CONTRACTOR'S INSPECTION

A. **Examination of Field Conditions:** Examine all surfaces and features to which Work must be applied, abut or clear. Notify Engineer in writing of all conditions which are or will be detrimental to proper and expeditious installation of Work. Starting of Work shall represent acceptance by Contractor of surfaces and of conditions as suitable and correct for performing Work as specified.

3.02 PREPARATION

A. Contractor shall prepare and clean substrates and remove any material which may interfere with the bond of the spray-on fireproofing. Follow the recommendations of the manufacturer and any additional requirements of the Owner or Testing Agency. Where conditions are not fully covered by the manufacturer's literature submitted, consult with the manufacturer's representative at the Project Site to determine the proper procedure required.

B. Provide masking, drop cloths or other satisfactory covering so as to prevent the overspray of replacement fireproofing. Provide special protection from overspray for elevator hoist cables, compensating cables, governor cables and selector tapes.

3.03 INSTALLATION

A. Provide spray-on replacement fireproofing as specified herein, in the thickness given in the Contract Drawings.

B. Use spray equipment of the type recommended by the fireproofing manufacturer. Where local conditions warrant, replacement fireproofing may be applied by trowel.

C. Extend material full thickness over entire substrate to be covered, in a monolithic blanket of uniform density and texture.

D. Where required by the manufacturer to comply with governing authorities, UL requirements, or these specifications, tamp the surface of freshly sprayed fireproofing to provide a medium smooth texture of the required thickness.

E. Where replacement fireproofing is found by Engineer or by Testing Agency to be defective, Contractor shall remove and replace the defective Work. Further, Contractor shall pay Owner for the actual amount of the fees of Testing Agency for the reinspection and the retesting of Work deemed defective by Engineer. The cost of all other activities and procedures associated with defective Work shall be paid by Contractor.

3.04 REPAIRING AND CLEANING

A. All patching and repair to replacement fireproofing shall be performed under this Section.

B. After the completion of Work of this Section in an area, equipment shall be removed from that area and all surfaces not to be sprayed shall be cleaned of all deposits of spray or trowel applied fireproofing. Floor areas and top of elevator cabs shall be broom cleaned.

END OF SECTION 7A

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DIVISION 7 - FIREPROOFING

SECTION 7B

TESTING AND INSPECTION OF SPRAY-ON FIREPROOFING

PART 1 - GENERAL

1.01 TESTING AGENCY

A. The PANYNJ Materials Division (Testing Agency) will perform all Testing and Inspections defined herein.

1.02 RELATED WORK OF OTHER SECTIONS

A. Related Work:

1. Spray-On Replacement Fireproofing: Section 7A.

1.03 TESTING AGENCY'S DUTIES AND RESPONSIBILITIES

A. Testing Agency shall collaborate with the Engineer and perform the services described herein. Testing Agency shall not have any responsibilities for other parts of the Project.

B. Testing Agency will be required to perform its services in character, sequence and time so that they will be coordinated with those of Contractor.

C. Nothing contained herein shall be interpreted as permitting Testing Agency to release, revoke, alter or enlarge on requirements of the Contract Documents, including approving or accepting any portion of the Work. Testing Agency may not perform or assume any duties of Contractor whatsoever. Testing Agency shall have no authority to stop work or cause the work to be halted for any reason whatsoever.

D. The Engineer shall have sole responsibility to approve or reject the results of tests performed by Testing Agency. The Engineer's decision shall be final and accepted by Contractor as binding.

1.04 CONTRACTOR'S DUTIES AND RESPONSIBILITIES

A. Contractor will be required to cooperate with and assist Testing Agency in the performance of their responsibilities. Contractor shall provide Testing Agency with free access to the Work site. Contractor shall provide Testing Agency with a complete set of ASTM and ULI certifications and Manufacturer's application instructions.

B. Contractor shall notify Testing Agency sufficiently in advance of operations to allow for Testing Agency assignment of personnel and scheduling of tests. Contractor will be required to reimburse the Owner for any expenses incurred by Testing Agency for failure to conduct tests, due to Contractor's negligence, in adhering to test schedules.

C. Contractor shall arrange with Testing Agency to conduct additional tests as a result of failure of materials to comply with test requirements.

D. Contractor will be required to remove, repair or replace material and work not in full compliance with the Contract Documents.

1.05 WORK INCLUDED

A. Where directed, Testing Agency will perform the following inspections and tests:

1. Inspect conditions of substrate daily, before application, for proper preparation of steel. Steel shall be free of dirt, grease, release agents, loose scale, extensive rust and loose paint (primer) which will prevent adhesion. Report areas not in compliance immediately for remedial action.

2. Test replacement fireproofing for density and thickness in accordance with ASTM E605.

3. Test replacement fireproofing for bond strength in accordance with ASTM E736.

4. Inspect and note whether or not corrective measures, including patching, have been properly carried out in all areas in need of respraying and patching, including areas where sprayed-on fire protection has been deliberately removed for testing, or has been damaged in any way.

5. Inspect replacement fireproofing for cracks. Replacement material shall not show any visual sign of cracking upon drying and curing.

6. All testing shall be based upon random samples and shall be the responsibility of the Testing Agency.

1.06 TESTING AND INSPECTION REPORTS

A. Testing and inspection services shall conform to all applicable provisions of ASTM E543, Standard Practice for Determining the Qualifications of Non-destructive Testing Agencies.

1. Testing and inspection services shall also conform to the requirements of the Building Code of the City of New York.

2. Refer to Section 7A -"Spray-On Replacement Fireproofing" for performance criteria for replacement fireproofing.

B. Reports on testing and inspection shall include complete detailed data with respect to all requirements of these specifications. All material or work which has been rejected or for which adjustment is required shall be specifically noted. In no case shall Testing Agency recommend to Contractor any method of adjustment.

C. **Submission of Test and Inspection Reports:** Results of all inspection and testing specified will be documented daily. Three (3) copies of each daily report will be required. Testing Agency will promptly mail simultaneously by FIRST CLASS MAIL or messenger, one copy of each report to Engineer, Contractor and Leslie E. Robertson Associates.

D. **Testing Agency Identification of Conforming/Non-Conforming Work:** Each test report shall prominently indicate, in a conspicuous location not obscuring the reported data, the conformance or non-conformance of the Work or material tested or inspected. A rubber stamp using black ink will be used to state conformance; a rubber stamp using red ink will be used to prominently call attention to non-conformance of material, completed Work, or Work in progress.

E. **Prompt Reporting of Non-Conforming Work:** When it appears to Testing Agency personnel that specific material or work fails to conform to the Contract Documents, Testing Agency will immediately direct the attention of Contractor and Engineer to each such deficiency by verbal communication and, where appropriate, note(s) or sketch(s). All such communications will be confirmed by appropriate test or inspection report and, if applicable, written details and explanation.

END OF SECTION 7B

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